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Maintenance Manual for the QEW Surveillance and Control System

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ABSTRACT

The Queen Elizabeth Way (QEW) Freeway Surveillance and Control System (FSCS) consisted of only five ramp controlling stations and five surveillance cameras during its early stage. These provided ramp metering at the entrance ramps of the interchanges of Hwy. 10, Mississauga Rd., and Southdown Rd.

An operator, stationed in an Ontario Provincial Police (OPP) detachment office, monitored the traffic by means of a remote control camera. This operator manually selected the ramp signal cycle lengths at each of the entrance ramps. However, during the past few years many new features have been added. These are: a central traffic control computer system; a changeable message sign; the expansion of the system east to Cawthra Rd. and west to Ford Dr. There has also been an addition of seven more cameras, and just recently the control room was moved to a better equipped trailer located outside the OPP detachment office. These additional features require that some modification be made to the original system.

The purpose of this manual is to provide maintenance crews with an up-to-date hardware arrangement of the system. It provides a schematic diagram, a functional block diagram, wiring tables, and a flow chart that can be used with the troubleshooting procedure.

The QEW FSCS can be divided into five main sections, as follows:

a) The computer control room;
b) The broadband coaxial trunk network;
c) The vehicle detection station;
d) The ramp controller station;
e) The changeable message sign.

Various other reports have previously discussed the central traffic control computer system in detail. For this reason this manual will not deal with it. However, a control room functional block diagram and a cable distribution diagram are provided in Figures 1 and 2.

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1/ PRINCIPLE OF OPERATION

Each vehicle detection station consists of a modem and six vehicle detector amplifiers. Each vehicle detector amplifier is connected to a 2 m^2 loop, consisting of three turns of number 14 gauge wire. It is buried in the pavement and is arranged as shown in Figure 1.

Vehicles driving over this group of loops are detected by the vehicle detector amplifiers and converted to digital signals, (which are modulated by the modem in a 238.5 MHz carrier). This carrier is transmitted through the broadband coaxial trunk network to the computer control room. The computer control room upon receiving this data, will then determine the average vehicle speed, number of vehicles, and occupancy time (in percentages) during certain time intervals at that particular location. Appropriate command signals are sent out based on the data coming back from all the vehicle detection locations. They are modulated by the head end modem on a 28.5 MHz carrier and then transmitted through the broadband coaxial trunk network to each ramp controlling station. This modulated carrier is demodulated by a modem to an eight-bit word that enables one of the six cycle lengths, which has been pre-programmed in the controller, to drive the Queen Elizabeth Way QEW on-ramp traffic signals. If necessary, the same procedure is used to send out warning messages which are displayed on the changeable message sign.

Two back up systems are used in case of computer failure.

a) Manual Operation

The system operator monitors freeway traffic through television cameras, and selects the cycle length for each ramp controller station by rotary switches in the control room. However, this system only applies to the Hwy. 10 and Mississauga Road interchange.

b) Local Control

Ramp controllers change their cycle lengths according to a pre-timed mode.

The cameras are operated on two control systems. The VICON 175 PM camera control transmitter transmits its signal through a twisted pair cable

controlling the cameras at Hwy. 10, the Credit River, the weigh scale between the Credit River and Southdown Rd, and at Southdown Rd. An amplifier at the weigh scale boosts the signal to Southdown Road.

The TOCOM camera control transmitter transmits its signal through the main trunk coaxial cable controlling the rest of the cameras.

2/ BROADBAND COAXIAL TRUNK NETWORK

This system consists of a .750 coaxial cable with a main line amplifier approximately 600 m apart and sub-return amplifiers approximately every 1200 m apart. The main line amplifiers operate at the passband of 50 - 250 MHz in the old section and 50 - 300 MHz in the new section. The sub-return amplifiers operate at the passband of 5 - 30 MHz. Three 120 VAC/60 VAC power supplies are used as power sources for the amplifiers. Directional couplers are used to tap off from the main trunk through a .412 cable to modem, television modulator and the camera control's receiver.

Carriers from modulators channel 4 (Winston Churchill Blvd.) and channel 13 of the Changeable Message Sign (CMS) are used as reference for the Automatic Gain Control (AGC) amplifiers.

All amplifiers (A-1W to A-8W) and directional couplers along Hwy. 10 to Southdown Road were mounted aerially at heights varying from 14 to 25 feet. A bucket truck is required for access to this equipment. All other amplifiers and directional couplers were mounted at ground level.

2.1/ Trouble-shooting and Broadband Coaxial Trunk Network

This network has been working quite satisfactorily for the past few years with little attention required. Following are some possible problems:

a) Wrong data comes back from all stations

This problem is either caused by the head end modem or missing AGC reference. To confirm the problem for missing AGC reference, check channel 4 and channel 13 carrier from the spectrum analyzer. Another symptom for missing AGC reference is bad picture quality from the television monitors.

b) No data or television signals come back from the lower section of the trunk network

This can be caused by several factors. A few are outlined below.

(i) Defective 110 VAC/60 VAC power supply

The symptom for this malfunction is that the data stops coming back from an amplifier with a power stop.

The 60 VAC can be checked with a volt meter measuring from the shield to the centre conductor of the input or output trunk tests conductor as shown in Figure 4.

(ii) Broken .750 coaxial cable
This usually occurs at a cable splice and can be tracked down by measuring 60 VAC from the input or output trunk test connector.

(iii) Defective amplifiers
To locate a defective amplifier, a Jerrold field strength meter (Model VSM -1) and a test probe (Model 2502 -30 dB) are required. Connect the VSM -1 and the probe to the input or output as shown in Figure 5.

The input and output trunk test connectors can also be reached without opening the amplifier housing cover. The test probe can be inserted into the test connectors by removing the two top bolts located at the front of the housing cover as shown in Figure 6.

To locate a defective sub-return amplifier, tune the VSM-1 to 28.8 MHz, to check the carrier from the head-end modem. To locate a defective main line amplifier, tune VSM-1 to 238.5 MHz, to check carrier from the remote modems.

c) No data from one particular station.

The problem usually is caused by a defective modem which will be discussed later. To locate the problem within the trunk network the VSM-1 is required to check the 28.8 MHz at the tap point in the station. If no carrier is observed, the problem will be a defective directional coupler or broken .412 cable.

2.2/ Recommendation

To maintain the system in satisfactory condition the following mesures should be taken:

a) Since carriers from channel 4 and channel 13 modulators are used as the AGC reference, these two modulators should be left turned on all the time and under all circumstances.
b) Spare modulators should be purchased for the above channels.

3/ VEHICLE DETECTION STATIONS

There are two types of detection stations. Detection Stations (DS), DS-1W to DS-6W are the old type (see Figure 28), and the rest are the new type.

a) Old Detection Stations

They consist of the Interactive System Incorporated (ISI) 820 single address modem and ISI pull-up resistor box, six Traffic Data Systems (TDS) LD328R and/or LD328's detector amplifier, A Spraque (filterol No. 3) surge protector, a General Electric (GE) power line lighting protector, heater, heater thermostat, exhaust fan, and fan thermostat.

b) New Detection Stations:

In general, the new stations are similar to the old ones with the exceptions of replacing the 820 modem with the 840 four-address modem and the elimination of the pull-up resistor box.

Refer to the wiring block diagram (Figure 7) and the wiring diagram of the detector station (Figure 8).

For modem 820 see Figure 9 and for Modem 840 see Figure 10.

4/ TROUBLE-SHOOTING DETECTION STATION

When detector data is suspected to be missing from a detection station, a modem ECHO test should be run, (For ECHO test procedure, refer to the ISI Manual). If the modem fails the ECHO test, replace the Radio Frequency (RF) cards with spares known to be operational. If the modem passes the ECHO test using the spare RF card, retune the defective RF card according to the ISI Manual. During the tuning procedure the phase counter is required to be frozen. Figure 11 illustrates a setup for retuning the RF card.

Below are the instructions to operate the Hewlett Packard (HP) 21MX microcomputer to freeze the phase counter of the old modem.

M register to 1000 (OCTAL) store.
T register to 106610 (OCTAL) store, clear display.
T register to 102501 (OCTAL) store, clear display
T register to 103615 (OCTAL) store, clear display
T register to 025000 (OCTAL) store, clear display
B register to 2 (OCTAL) store.
P register to 1000 (OCTAL) store, preset, run.
S register to the modem's address in OCTAL number for the modem which is under tested.

For the new 840 modem, there is a switch on the RF card to freeze the phase counter.

If the modem passes the ECHO test the problem can be open loops, loop's broken lead-in wire, serial card or 32 Bit input card. To locate the problem check hardware error from the Dasher terminal by pressing key H and return. The hardware error listing will show all malfunctioning loops' numbers. Check equipment location layout for the location of the malfunctioning loops', e.g., loop 67 will be the East Passing Lane loop, (EPL) located at detection station DS -6W (refer to Figure 28).

At the detection station, use the following procedure to locate the problems.

Symptoms from the Detector Amplifier	Possible causes and actions that may be taken.
1) Detector's Light Emitting Dial, (LED) light stays on or stays off.	a) Detector is off tune. Retune amplifier. b) Loops or lead-in wire is open. Replace loops or lead-in wire. c) Loops or lead-in wire shorted to the ground (a Mega Meter is required to measure shorts). Locate and repair shorts. d) Defective detector amplifier. Replace and repair amplifier.
2) Blinking detector LED light.	a) Detector is off tune. Retune detector amplifier. b) Defective detector amplifier. Replace and repair detector amplifier, (this problem is usually caused by defective differential amplifier Integrate Circuit (IC), CA 3026).
3) Detection LED light is working properly, i.e., LED comes on only when vehicle is driving on the loop.	a) For old detection station remove serial card; for new detection station remove modem input wiring at terminal block. Measure output of the detector's voltage level with respect to the ground at the terminal block. (Refer to detection station wiring diagram in Figure 8). Observe a Transistor Transistor Logic (TTL) high level

when the detector is not actuated, and a TTL low level when the detector is actuated. If the above is not obtained, the problem will be at the output section of the detector amplifier. Check and replace IC 2 and/or Q29. If correct voltage is obtained, the problem will be at the modem.

b) For the old detection stations it will be the serial card. For West Driving Lane (WDL) loop replace IC 19. For East Driving Lane (EDL), West Centre Lane (WCL), East Centre Lane (ECL) or West Passing Lane (WPL) replace IC 17; and for East Passing Lane (EPL) replace IC 18.

c) For the new detection stations, the problem will be mainly at the 32 bit input card, or at the serial card. For WDL, EDL, WCL, and ECL, replace IC 16 at the 32 bit. input card.

5/ RAMP CONTROLLER STATION

There are two types of ramp controller stations. The Ramp Controller Stations (RC), RC-1W to RC-5W belong to the old type. They are located at the interchange of Hwy 10 Mississauga Road and Southdown Road. Each controls one on-ramp traffic signal light. The RC-6W and RC-1E belong to the new type. They are located at Winston Churchill and Cawthra Road. The stations use the 170 controller, which enables them to simultaneously control both the northbound and southbound on-ramps'traffic signal lights.

5.1/ Old Ramp Controller Stations

They consist of a TDS CR 710 controller, an ISI 840 modem, ISI pull-up resistor box, a level convertor box, two load switches, a flash, a flash-transfer relay, TDS model LD328R and/or LD 328S detector amplifiers, a timer unit, four cycle-length relays, power surge filter, power line lighting protector, heater, heater thermostat, an exhaust fan and fan thermostat.

5.2/ New Ramp Controller Stations

They consist of model 334 cabinet, which includes a 170 controller, an input file with the capacity of 24 detector amplifers, a 24 V power supply, an output file which includes three load switches, and a watch-dog relay.

Also, the cabinet includes an ISI 840 modem, an interface unit, (see Figures 25 and 26 and Tables 1 - 3) a heater, an exhaust fan, and fan thermostat.

5.3/ Cabinet Wiring Diagrams for Old Ramp Controller Stations

In the old ramp controller station each cabinet is wired differently. A general wiring diagram (Figure 12) for all station cabinets, additional updated wiring for each cabinet, and a wiring block diagram for each cabinet are provided. Figures 13 - 23 are located at the back of this manual.

6/ TROUBLE-SHOOTING OLD RAMP CONTROLLER STATION

Since the wiring in the old ramp controller cabinet is very complicated, to have a better understanding of how to track down a missing detector data problem, let's assume the volume at a ramp controller station is suspected to be too low. A modem ECHO Test is executed and shows no timing error. The hardware failure listing shows that loop 10 has malfunctioned. From the hardware location layout, we find that loop 10 is the upstream driving lane (WDL) located at RC - 2W ramp controller cabinet, i.e., at Hwy. 10 Southbound, QEW on-ramp cabinet. At the site the LED light of the detector amplifier is coming on and off with the traffic, which means the loop and front end of the detector amplifier are working properly. The Hwy. 10 wiring block diagram shows that WDL has two output paths. One path goes to the CR710 controller, the other path goes to the input of the level converter box; from the output of the converter box it goes to (Terminal Block) TBA, then through the ISI pull-up resistor box to input address number 4 of modem 840.

From TBA function layout diagram (p. 33, 35) WDL is at position 13 which goes to input address number 4 bit zero of modem 840. This point with reference to the ground should be at a TTL high level when the loop is not activated, and at a TTL low level when the loop is activated. If the above voltage level is not obtained, remove the 32 bit input card from the modem and measure again. If the correct voltage level is obtained, trace the input address number 4 bit zero to defective IC 8 at 32 bit input card. (Note: If bit zero of all number 4 addresses are bad, the problem will be IC 19 at serial card). If the correct voltage level is not obtained by removing the 32 bit input card, follow the additional wiring diagram from TBA-13 to LC output-9 to LC input-9 to TB7-5. At this point the low and high logic level should be 0 and 15 V. If this level is obtained, replace IC 4050 in the level converter box. If proper voltage is not obtained, remove the connector at WDL detector amplifier. If 15 V, with reference to the ground is obtained, the problem is located in the output section of the detector amplifier. Replace IC 2 and/or Q29 in the detector amplifier. If 15 V is not obtained, follow general cabinet wiring from TB7-5 to TB1-B8 to J2-B to control Central Processing Unit (CPU) card and check for open diode CR 6, open resistor IC 21, or defective IC 18.

The problem mentioned on the page before is one of the typical problems. The following are some of the problems that can occur in the old ramp control station.

a) The controller does not cycle in any cycle length with the computer control.

This can be caused by the modem or controller, therefore check it before making any further attempt in trouble-shooting the problem. It is very important to turn off the signal on-off switch, located on the inside cabinet door, in order to prevent the traffic signal light from cycling during the trouble-shooting.

Remove the J1 connector from the controller, put the count-down-display switch on the controller to count-down position, hook up the computer simulation box to the controller simulation box, switch the hold-on-line switch to the right, a computer on-line signal will appear at the controller display. Follow the table below to execute the six-cycle length and observe the controller for operation.

Switch to Right	
C0	CYC. A1
C1	" A2
C0, C1	" A3
C2	" B1
C2, C0	" B2
C2, C1	" B3
C2, C1, C0	MAN. CYC

If the controller operates properly, the problem is at the modem. Replace the control card, the serial card, or the timer cards, with spares known to be operational.

If the controller is not operating with the computer simulation box, check the program in the controller. If the program drops out, reprogram the controller according to the programming procedure on the inside cabinet door. If the controller still does not operate, remove the computer simulation box, use the time clock switches on the inside cabinet door to execute the six cycle length. If the controller operates,

the problem will be IC in the elementary card or IC 20 in the CPU card. If the controller still does not operate, replace the power supply card, CPU card, memory card, or input/ output card.

b) **The controller does not cycle in any cycle length with the manual control.**

Manual control will be used during computer failure. With manual control, the problem can still be caused by modem. If the hold on the line bit is stuck on the modem all the time, it will over-ride all other modes of control and prevent the manual control from functioning. This can be identified by a computer on-line signal displayed on the controller when the display-count-down switch, also on the controller, is switched to the display position. This problem is caused by the control card, usually the output IC 7407. If the computer on-line signal is not observed, hook up the computer simulation box to check the controller as mentioned before. If the controller operates, check IC 1 and IC 3 in the input/output card. It can also be caused by the cycle length relay, located at the bottom of the left-side wall. Figure 23 shows the wiring between the manual control switches in the computer room to the relay on the cabinet.

If the controller still does not operate with the computer simulation box, replace controller cards to locate the defective card.

c) **The controller does not cycle with one or more particular cycle length of the computer control.**

Check control card, elementary card and CPU card.

d) **The controller does not cycle with one or more particular cycle length of the manual control.**

Check cycle length relay on input/output card or CPU card.

e) **The controller operates by itself in external mode without external controls.**

Check for sticky cycle length relays, input/output card, modem out-put card.

f) **The controller is operating but some traffic signal lights are not coming on.**

Check for light bulbs, load switch number 2, input/output card or broken cable.

g) **The metering-on warning light is not on.**

Check switch number 1, flasher transfer relay, input/output card, light bulbs or broken cable.

7/ THE CHANGEABLE MESSAGE SIGN

The changeable message sign station consists of an ISI 840 modem and a Farranti Packard sign controller (Refer to Figure 27).

If the Changeable Message Sign (CMS) is found to be malfunctioning, a modem ECHO test should be executed. (Refer to the previous chapter for checking the modem). If the modem is checked and found to be functioning properly, contact Farranti Packard to make arrangements for on-site service.

7.1/ Routine Maintenance for the Whole System

1) A heater should be installed at each detection station in winter, and replaced with a filter in the summer.
2) The thermostats for the heater and exhaust fan should be checked twice a year.
3) The exhaust fan cover, in all detection stations, should be removed in the summer and closed in the winter.
4) The camera housing ventilation plate should be removed in the summer and installed in the winter.
5) At the same time, windshield wiper blades should be checked for wear and replaced if required.
6) Check camera heater and thermostat.

INTERFACE UNIT			170 CONTROL	MODEM 840
TB A	TB A	C 2	C 1	J 3
1	9	J	67	2
2	10	K	68	3
3	11	L	69	4
4	12	M	70	5
5	13	N	71	6
6	14	P	72	7
7	15	Q	73	8
8	16	R	74	9

INTERFACE UNIT			170 CONTROL	MODEM 840
TB B	TB D	C 2	C 1	J 1
1	1	S	19	2
2	2	T	20	3
3	3	U	21	4
4	4	V	22	5
5	5	W	23	6
6	6	X	24	7
7	7	Y	25	8
8	8	Z	26	9

INTERFACE UNIT		O/P FILE	
TB B	RELAY COILS	LS 1	LS 2
9	RL 1	6	
10	RL 4	8	
11	RL 2	10	
12	RL 5		6
13	RL 3		8
14	RL 6		10

Table 1/ Interface Unit Wiring List

INTERFACE UNIT				170 CONTROL	I/P FILE	DET LOOP
TB C	IC 1	IC 3	IC 5			
1	3			40	T12–3	PASS 1
2	5			41	T12–2	DEM 1
3	7			43	T13–2	Q 1
4	9			39	T1–3	PASS 2
5	11			46	T1–2	DEM 2
6	14			50	T2–2	Q2 2
7		3		42	T13–3	OFF N
8		5		47	T2–3	OFF S
9		7		51	T5–2	UDL
10		9				
11		11		52	T5–3	UCL
12		14				
13			3	57	T6–2	UPL
14			5			

INTERFACE UNIT							MODEM	DET LOOP
TB E	IC 1	IC 3	IC 5	IC 2	IC 4	IC 6	J 2	
1	2			1			2	
2	4			3			3	
3	6			5			4	
4	10			9			5	
5	12			11			6	
6	15			13			7	
7		2			1		8	
8		4			3		9	
9		6			5		14	
10		10			9		15	DDL
11		12			11		16	
12		15			13		17	DCL
13			2			3	18	
14			4				19	DPL

Table 2/ Interface Unit

INTERFACE UNIT		MODEM
TB D	RELAY O/P	J 1
9	R 1	14
10	R 2	15
11	R 3	16
12	R 4	17
13	R 5	18
14	R 6	19

INTERFACE UNIT			MODEM	334 CABINET
TB F	P C B	RA	J 1	
1	+ 5 V		1	
4	GND		2	
7	+ 24 V	1		
		7		TB 1 PIN 1
		12		P – 7
		13		AC NEG

JUMPER T.B.F. 7 TO T.B.F. 6

750 Ω 1 W RESISTOR ACROSS T.B.F. 6 AND T.B.F. 5

Table 3/ Interface Unit and Modem

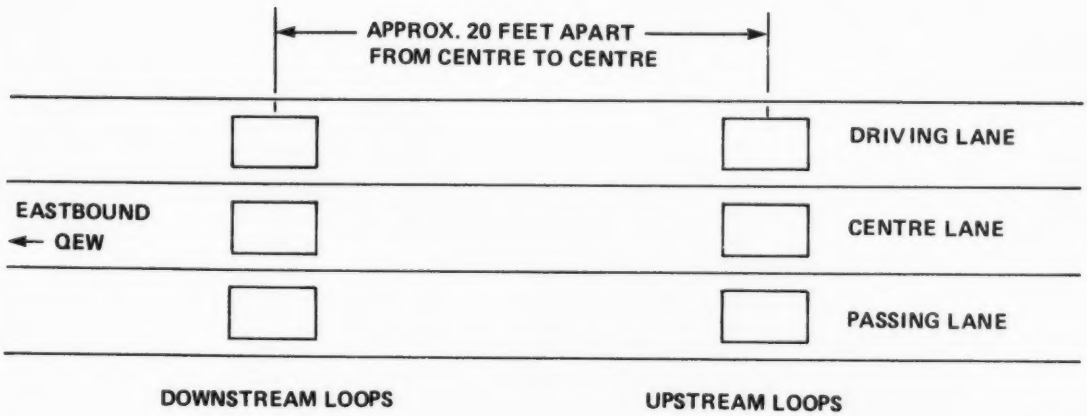


Figure 1/ Loop Arrangement

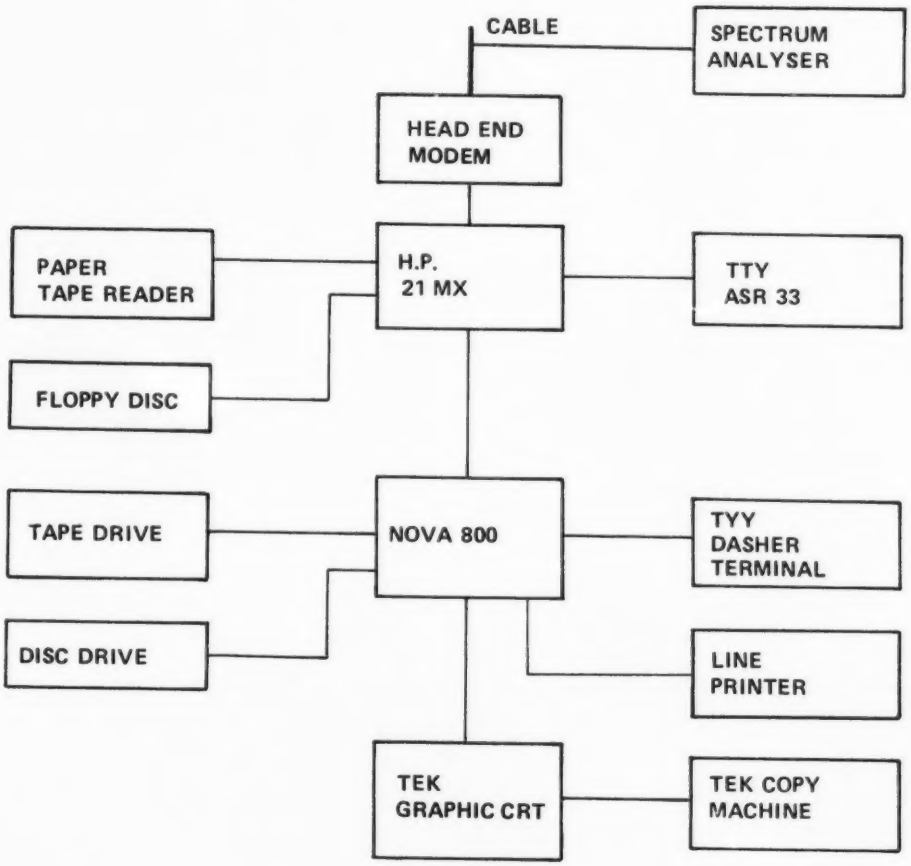
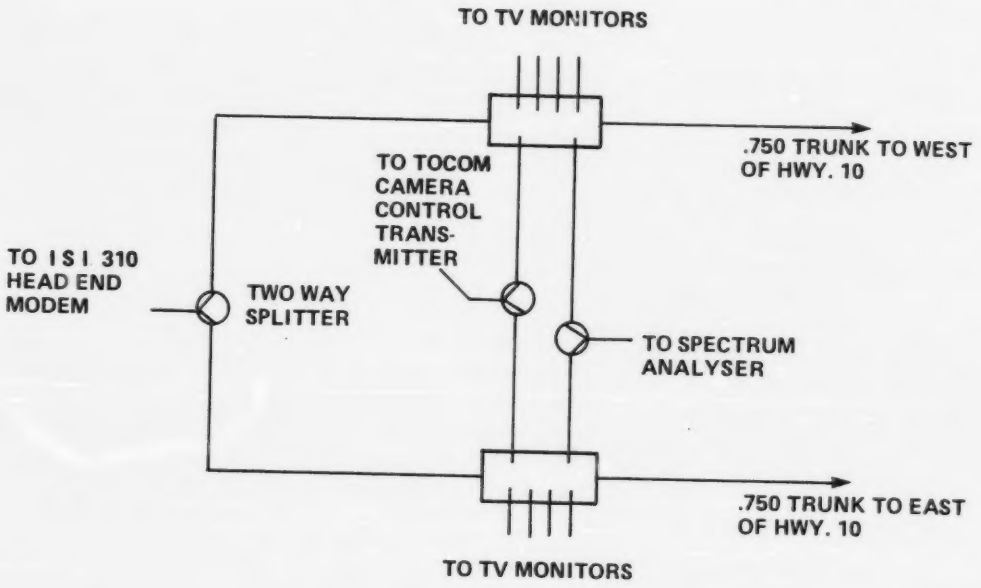
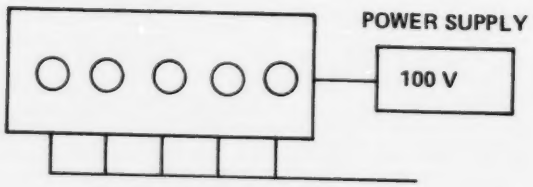


Figure 2/ Q E W Equipment Block Diagram in Control Room


TO TV MONITORS
.750 TRUNK TO WEST OF HWY. 10
TO TOCOM CAMERA CONTROL TRANS-MITTER
TO I S I 310 HEAD END MODEM
TWO WAY SPLITTER
TO SPECTRUM ANALYSER
.750 TRUNK TO EAST OF HWY. 10
TO TV MONITORS

VICON 175 PM CAMERA CONTROL TRANSMITTER



CR 710 CONTROLLER MANUAL CONTROL PANEL

Figure 3/ Control Room Cable Distribution Diagram

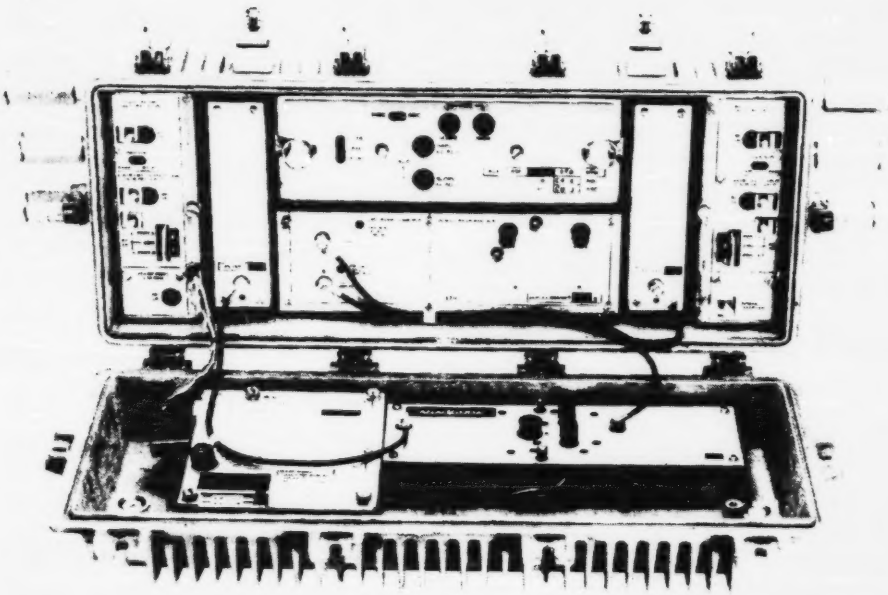


Figure 4/ Jerrold Field Strength Meter VSM-1 (R F Input)

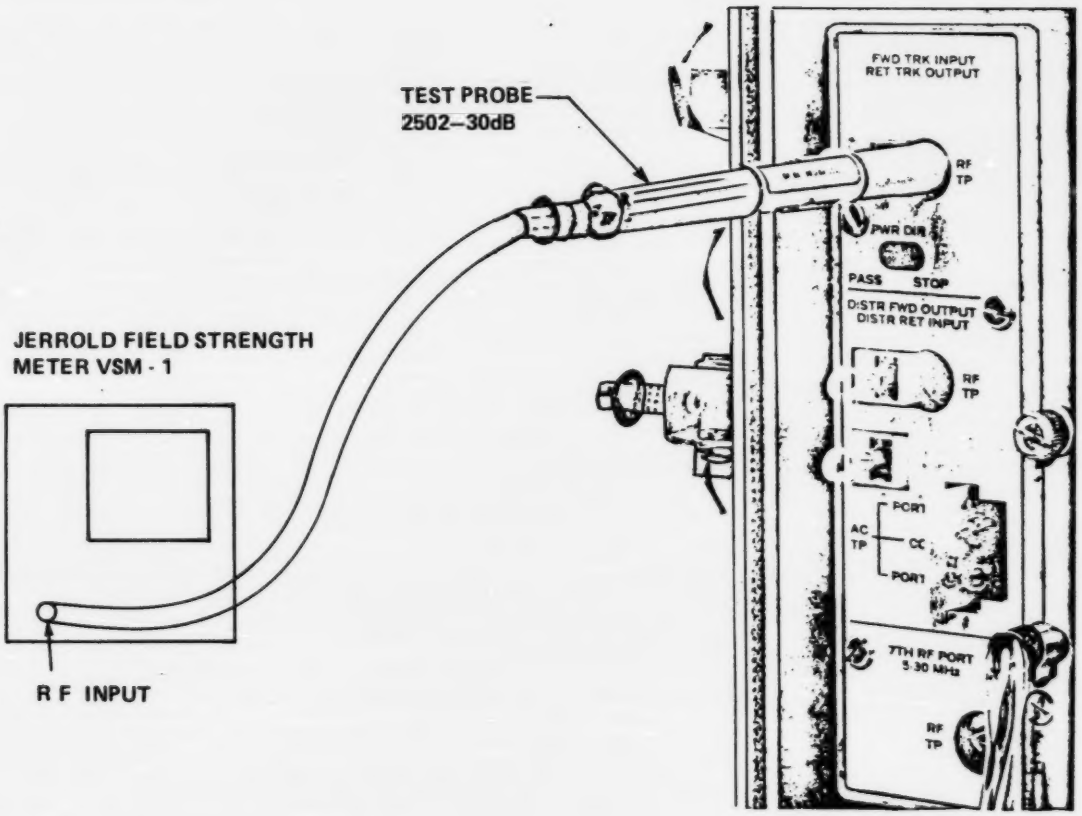


Figure 5/ Model 2502- 30 dB Test Probe Connected to Downstream Input (Upstream Output) Trunk Test Connector

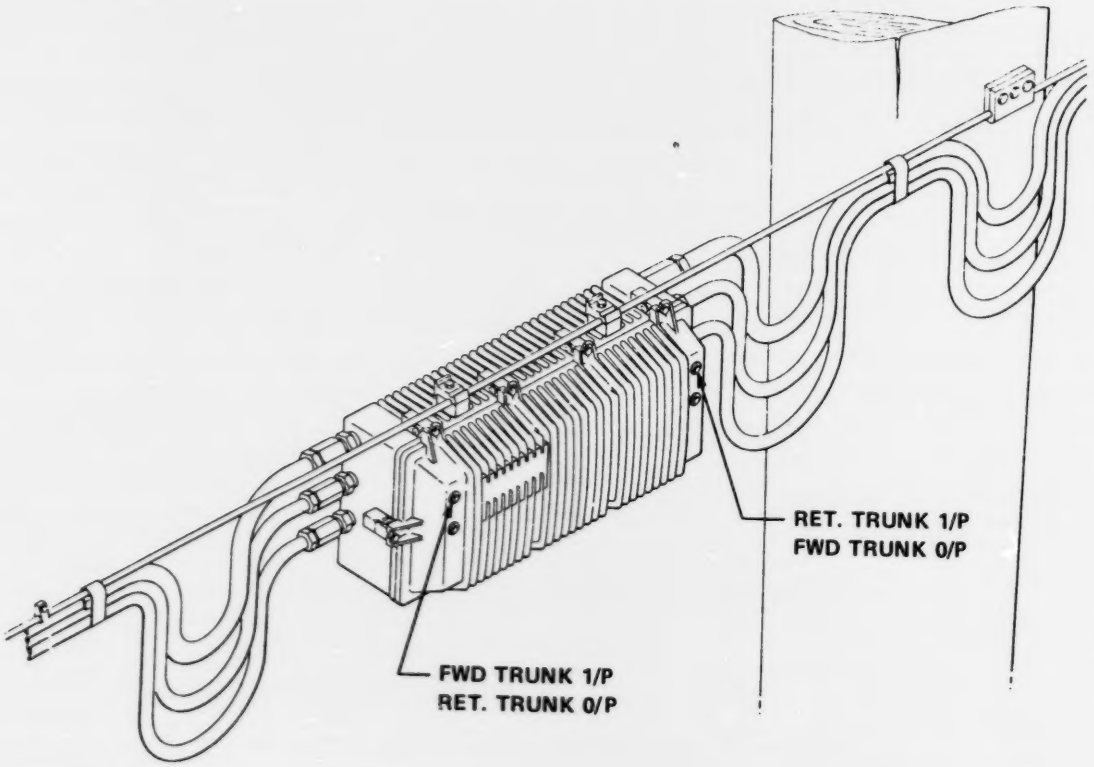


Figure 6/ The Trunk Test

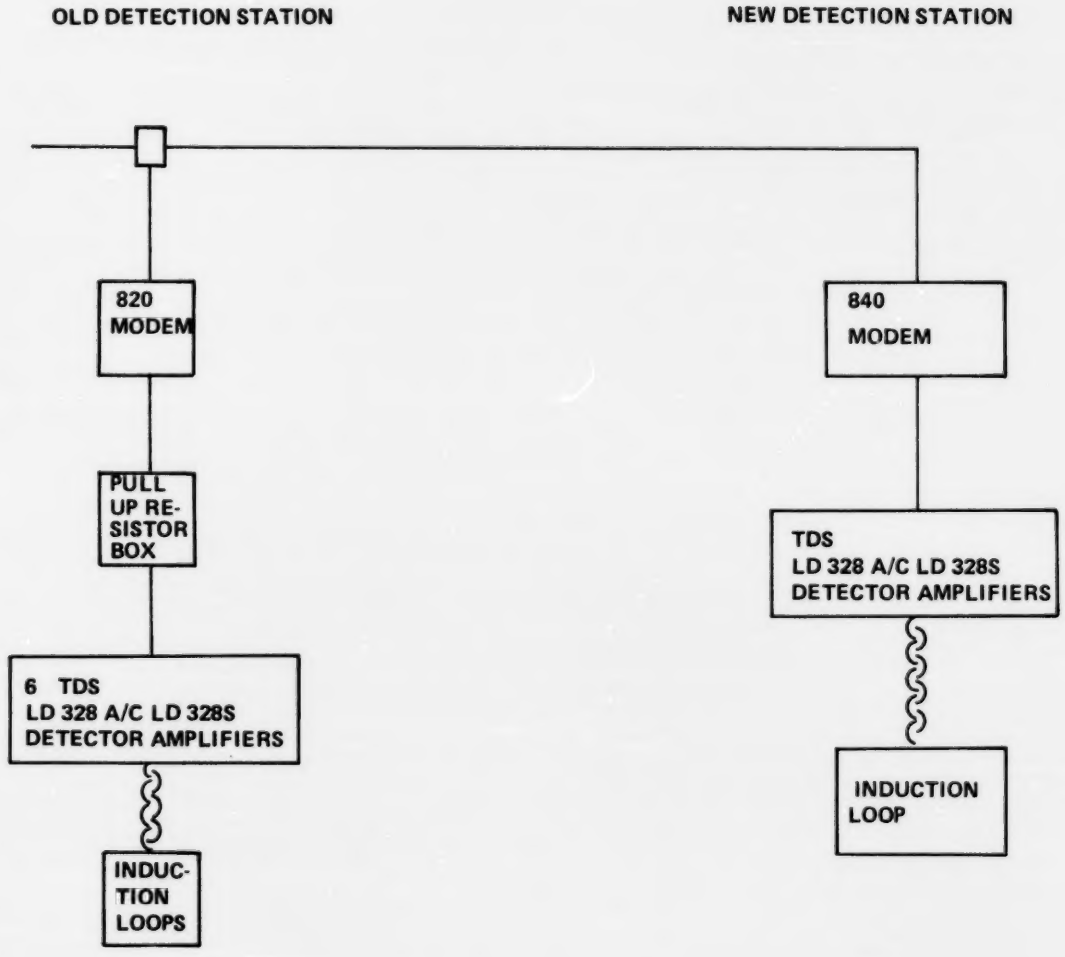
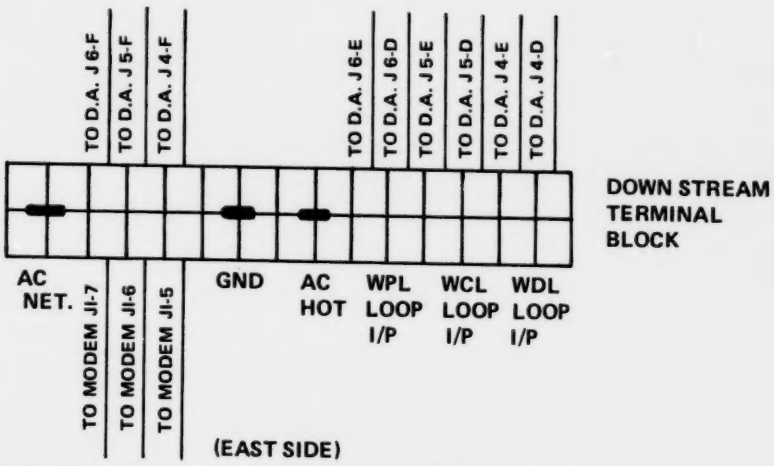
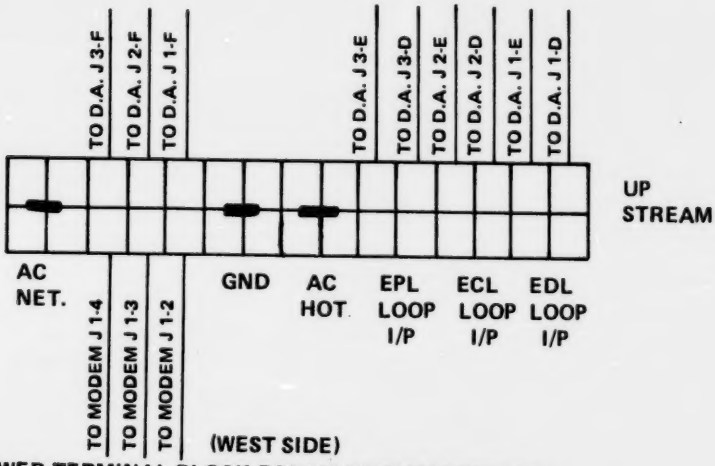


Figure 7/ Wiring Block Diagram of a Detection Station



UPPER TERMINAL BLOCK FOR DOWN STREAM DETECTOR



LOWER TERMINAL BLOCK FOR UP STREAM DETECTOR

LEGEND:
E – EAST
W – WEST
DL – DRIVING LANE
CL – CENTRE LANE
PL – PASSING LANE

LOOP LOCATION	DET. AMP. CONN.	MODEM J 1 - CONN. PIN NUMBER	MODEM I/P BIT NUMBER
WDL	J 1-F	2	0
EDL	J 2-F	3	1
WCL	J 3-F	4	2
ECL	J 4-F	5	3
WPL	J 5-F	6	4
EPL	J 6-F	7	5

Figure 8/ Wiring Diagram of a Detection Station

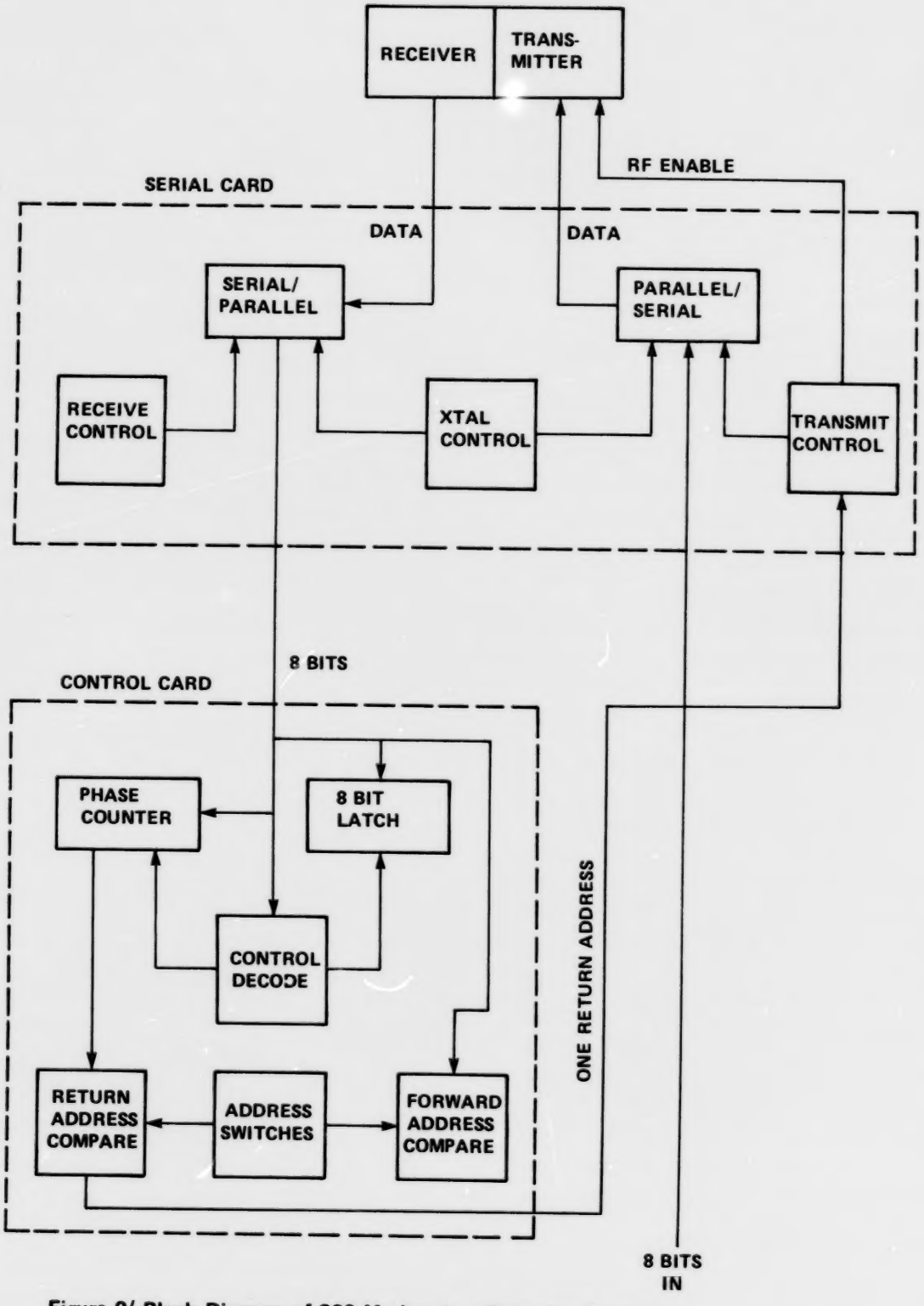


Figure 9/ Block Diagram of 820 Modem in a Detection Station

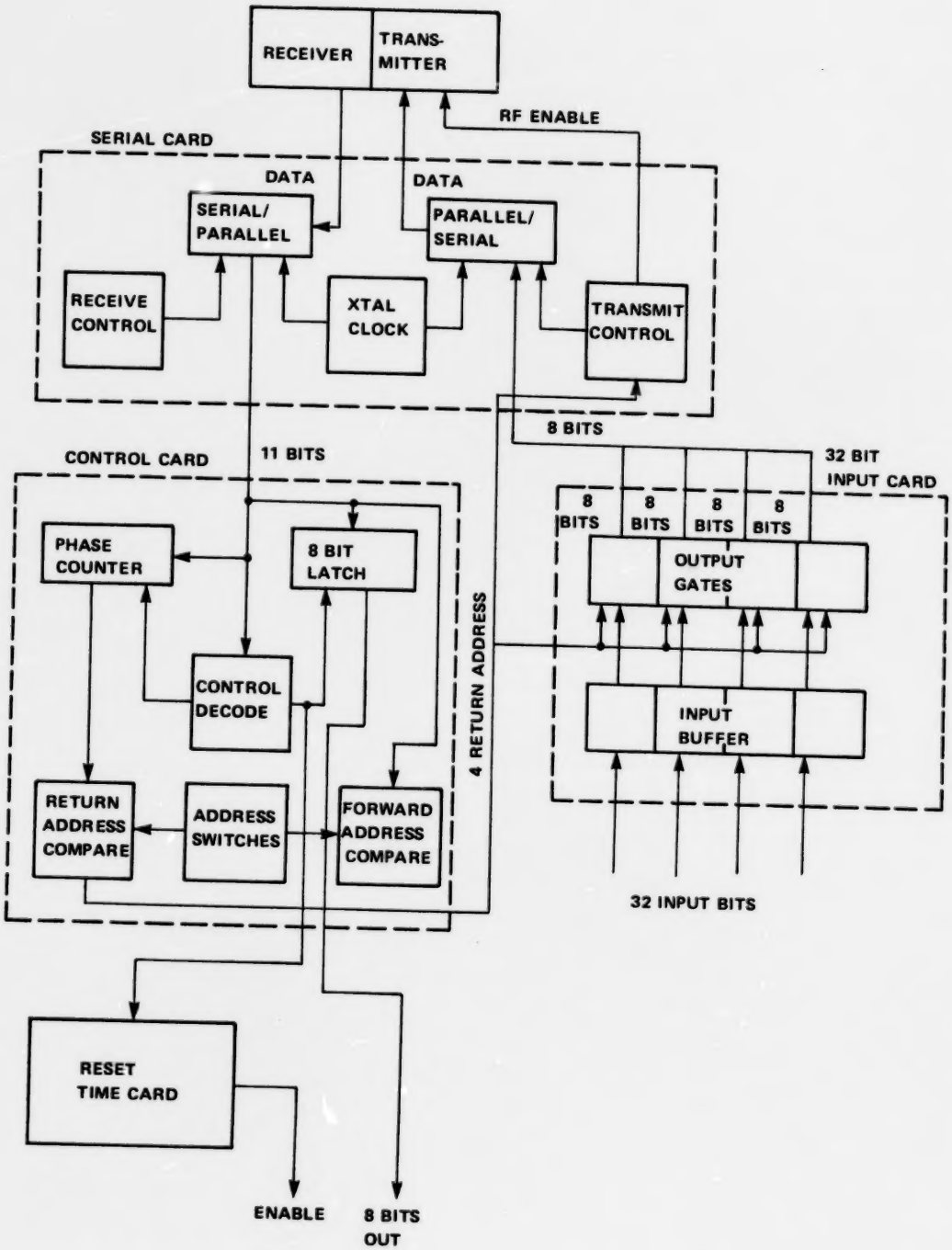


Figure 10/ Block Diagram of 840 Modem

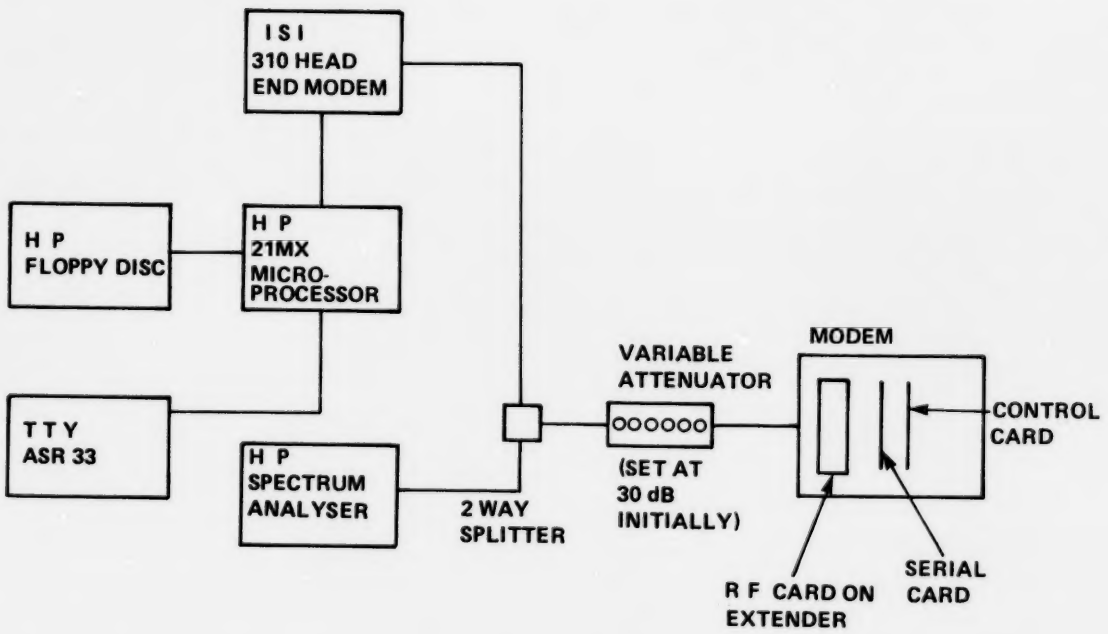
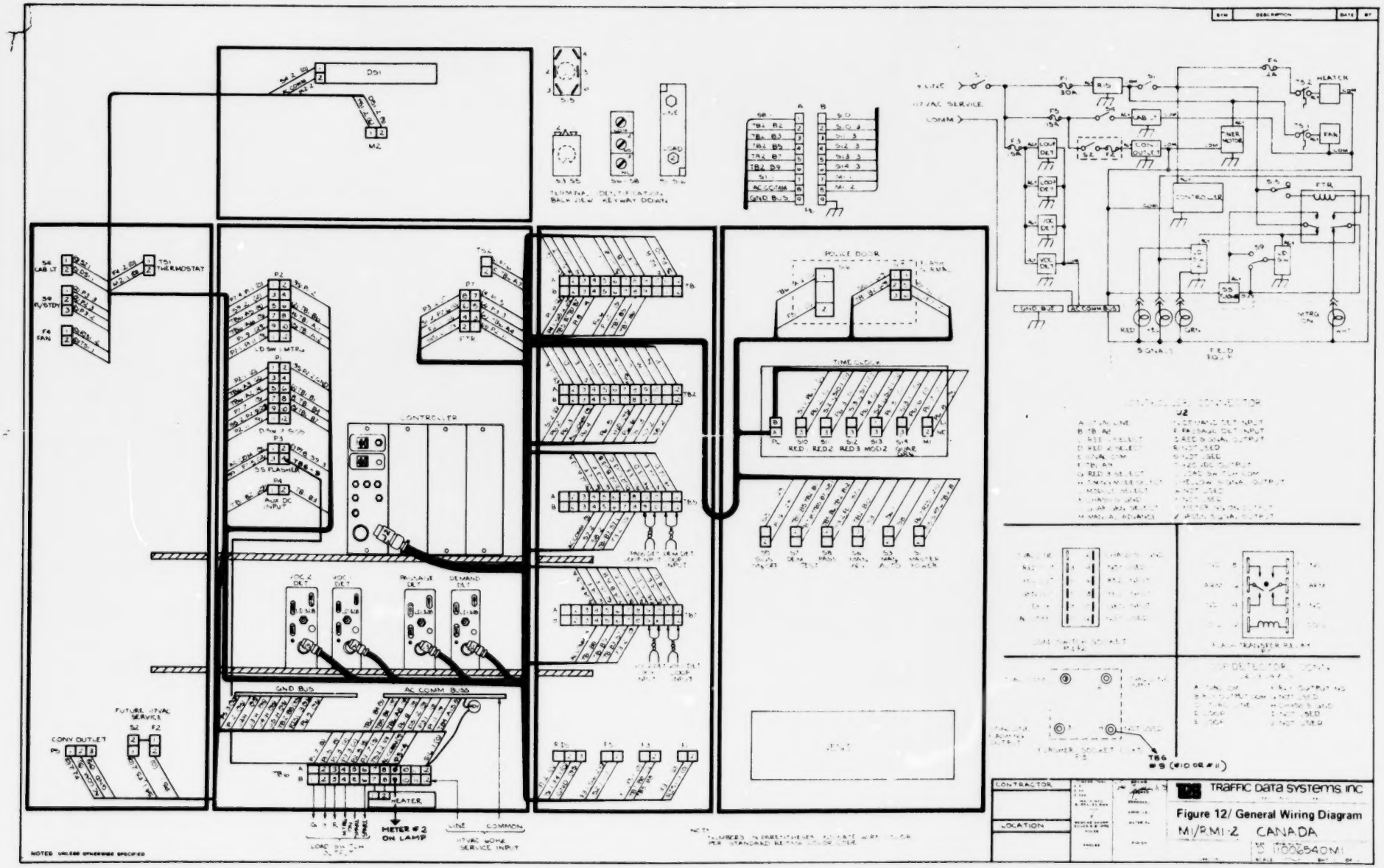


Figure 11/ Trouble-Shooting Detection Station


CONTROLLER
POLICE DOOR
TIME CLOCK
HEATER
METER #2 ON LAMP
LINE
COMMON
GND BUS
AC COMM BUS
CONV OUTLET
FUTURE HVAC SERVICE
TRAFFIC DATA SYSTEMS INC
Figure 12/ General Wiring Diagram
MI/RMI-2 CANADA
CONTRACTOR
LOCATION

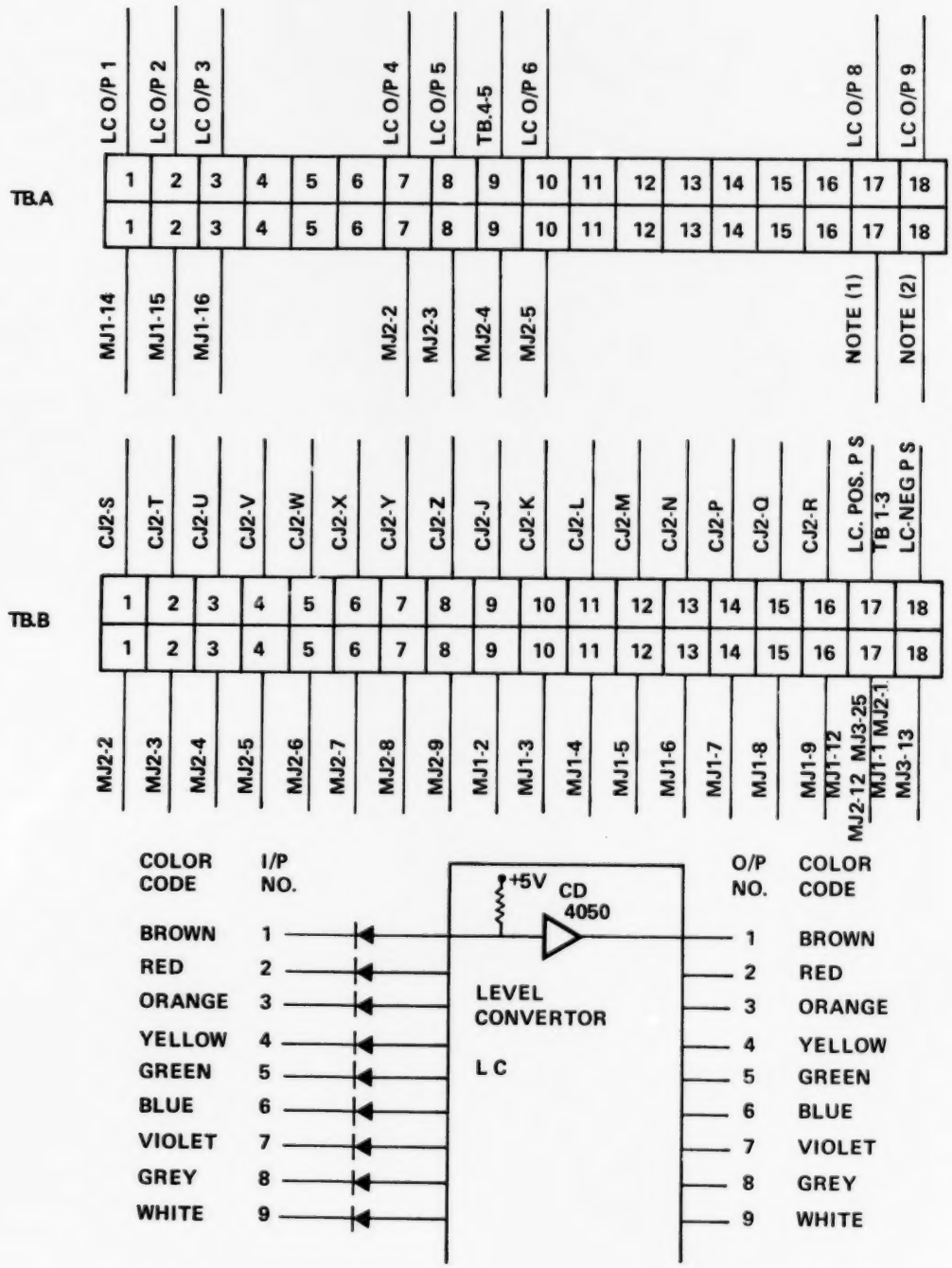


Figure 13a/ Terminal Blocks A and B

TB.3

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

TB.4

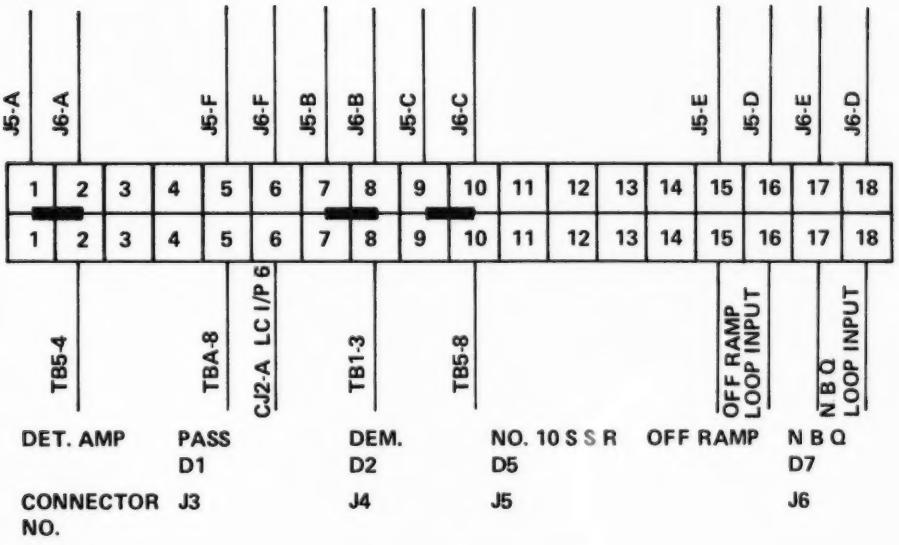


Figure 13b/ Terminal Blocks 3 and 4

LC - LEVEL CONVERTOR

LC 1/P 1 TO TB1-1
LC 1/P 2 TO TB1-4
LC 1/P 3 TO TB1-7
LC 1/P 4 TO TB5-6
LC 1/P 5 TO TB5-5
LC 1/P 8 TO TB7-5
LC 1/P 9 TO TB7-6

NOTE 1) *TBA-17 goes to TBA-18 at Hwy. 10 Southbound (SB) Cabinet.
2) *TBA-18 goes to TBA-14 at Hwy. 10 Southbound (SB) Cabinet.

*TB - Terminal Block

FIGURE 13c/ WIRING LIST FOR HIGHWAY NUMBER TEN, NORTHBOUND (ADDITIONAL CABINET WIRING)

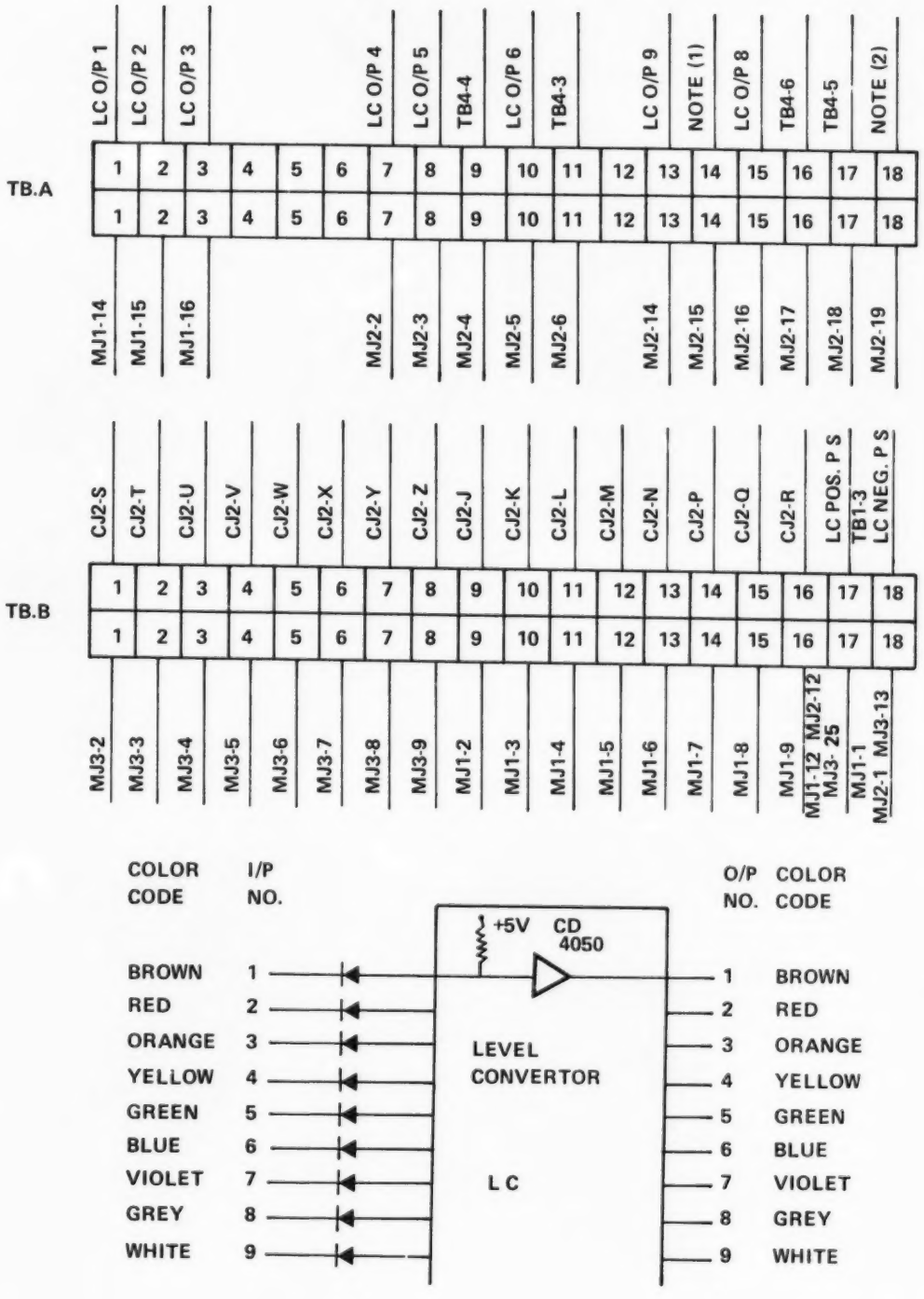
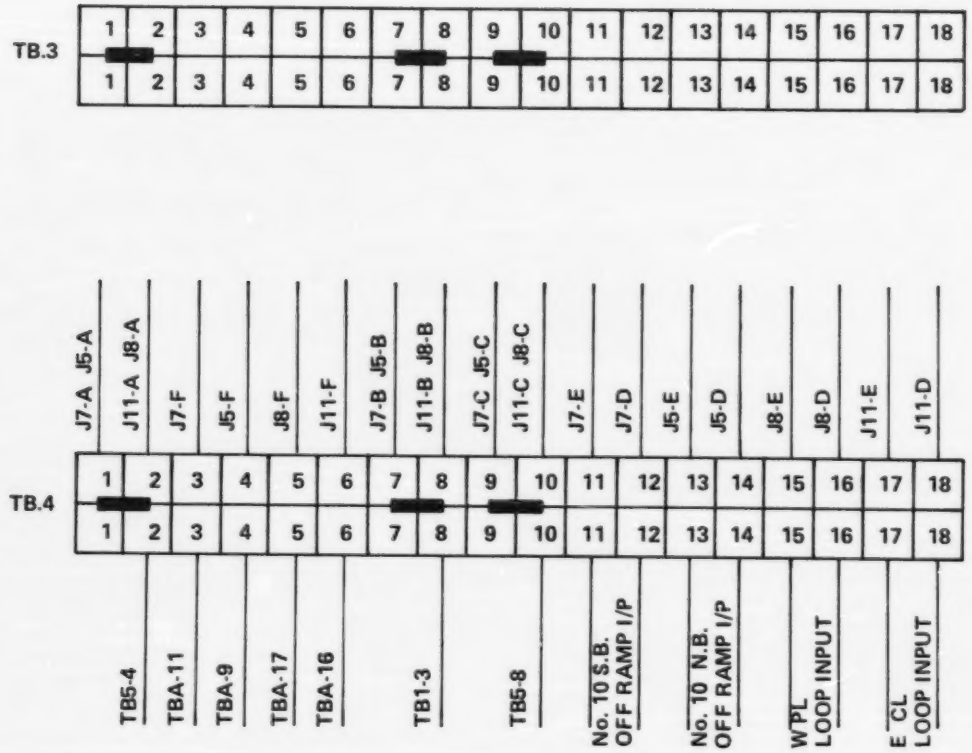


Figure 14a/ Terminal Blocks A and B



DET. AMP	PASS	DEM	N B OFF RAMP	S B O.	S B. OFF RAMP
	D3	D4	D6	D8	D9
CONNECTOR NO.	J3	J4	J5	J6	J7

DET. AMP	WPL	EPL	WCL	ECL	WDL	ECL
	D14	D15	D12	D13	D10	D11
	J8	J9	J10	J11	J12	J13

Figure 14b/ Terminal Blocks 3 and 4

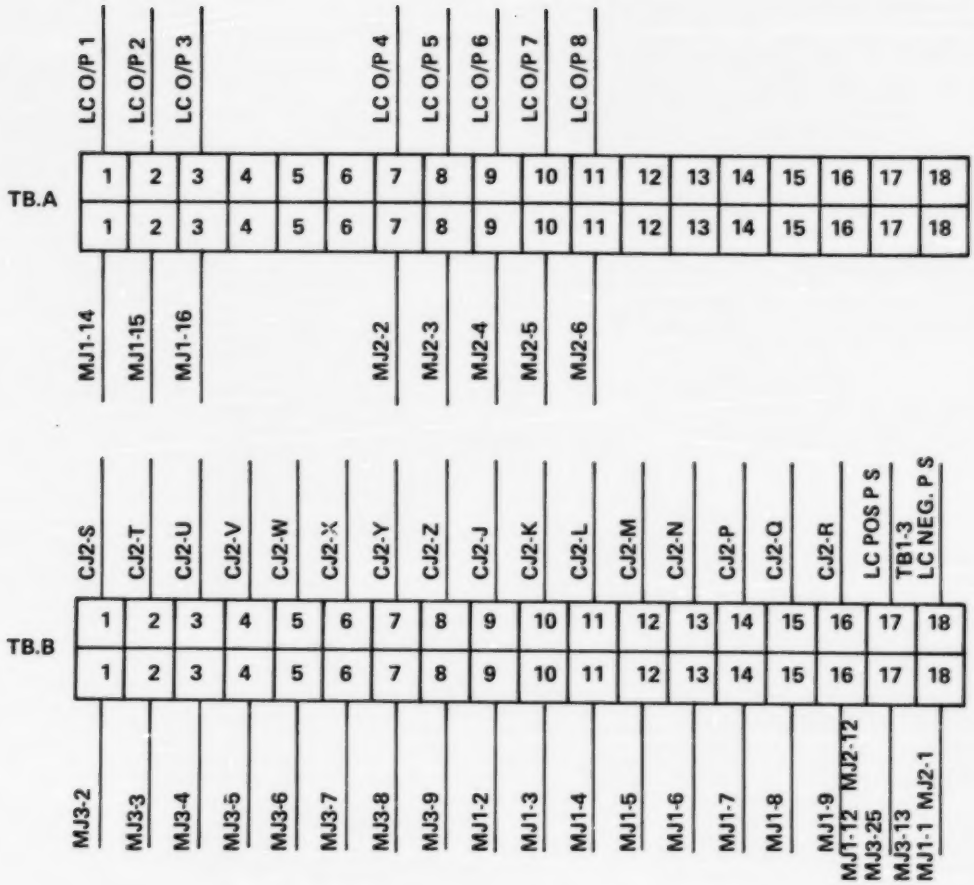
LC 1/P 1 TO TB1-1
LC 1/P 2 TO TB1-4
LC 1/P 3 TO TB1-7
LC 1/P 4 TO TB5-6
LC 1/P 5 TO TB5-5
LC 1/P 6 TO TB5-3
LC 1/P 8 TO TB7-6
LC 1/P 9 TO TB7-5
*CJ2-A TO TB5-3

Detector (D) amplifier, D11 and D15 are located at Hwy 10 Northbound Cabinet. Detector amplifier D8 is located at the traffic signal cabinet which is found at the intersection of North Service Rd. and Hwy 10.

*CJ - Controller Connector

NOTE: 1) TBA-14 goes to TBA-18 at Hwy. 10 Northbound Cabinet.
2) TBA-18 goes to TBA-17 at HWY #10 Northbound Cabinet.

FIGURE 14c/ WIRING LIST FOR HIGHWAY NUMBER TEN, SOUTHBOUND (ADDITIONAL CABINET WIRING)



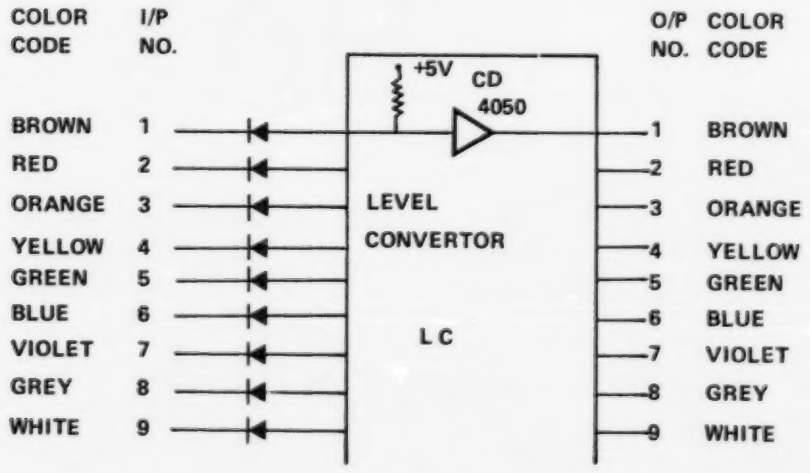
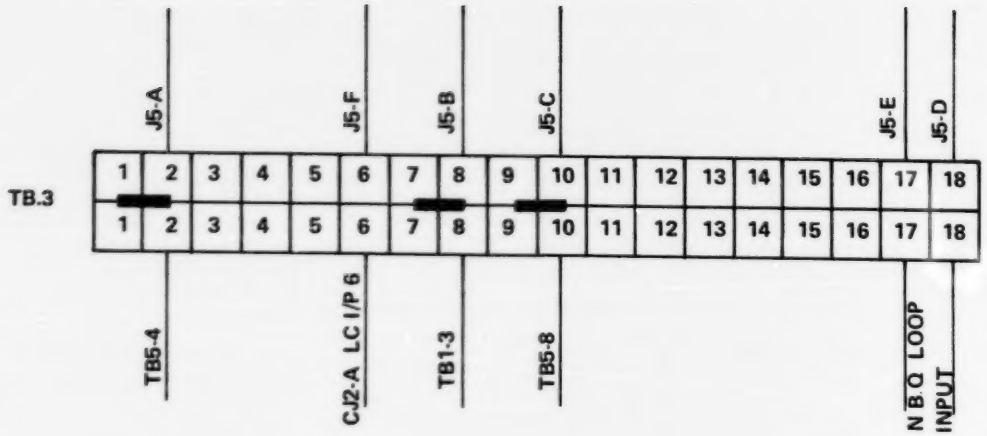
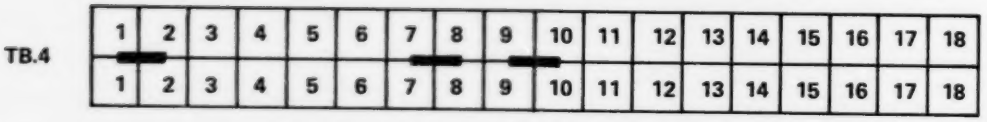


Figure 15a/ Terminal Blocks A and B





DET. AMP	PASS D28	DEM D29	N.B.Q. D30	DL D36	CL D37
CONNECTOR NO.	J3	J4	J5	J6	J7

Figure 15b/ Terminal Blocks 3 and 4

LC 1/P - 1 TO TB1-1
LC 1/P - 2 TO TB1-4
LC 1/P - 3 TO TB1-7
LC 1/P - 4 TO TB5-6
LC 1/P - 5 TO TB5-5
LC 1/P - 7 TO TB7-5
LC 1/P - 8 TO TB7-6

FIGURE 15c/ WIRING LIST FOR MISSISSAUGA ROAD NORTHBOUND
(ADDITIONAL CABINET WIRING)

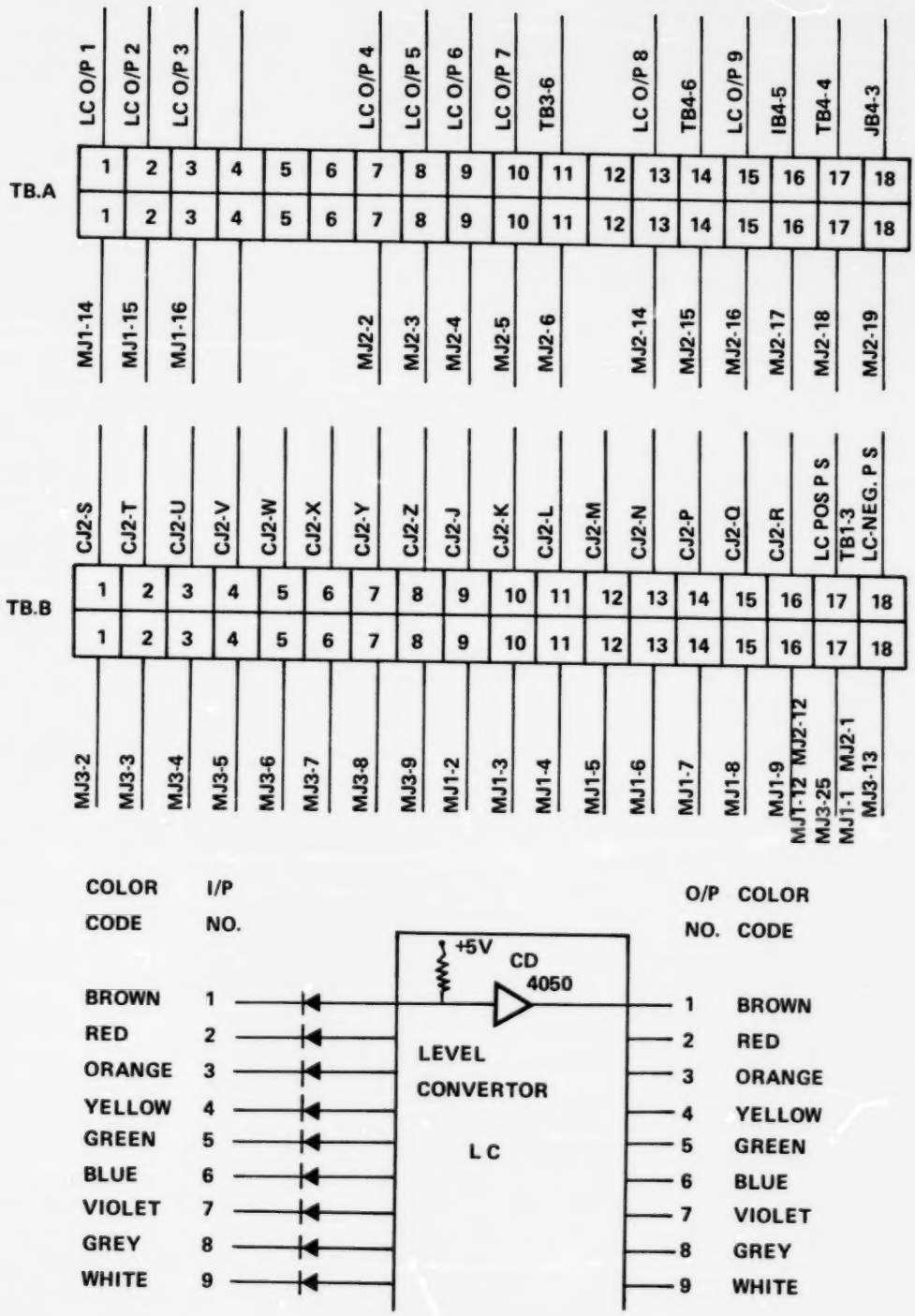
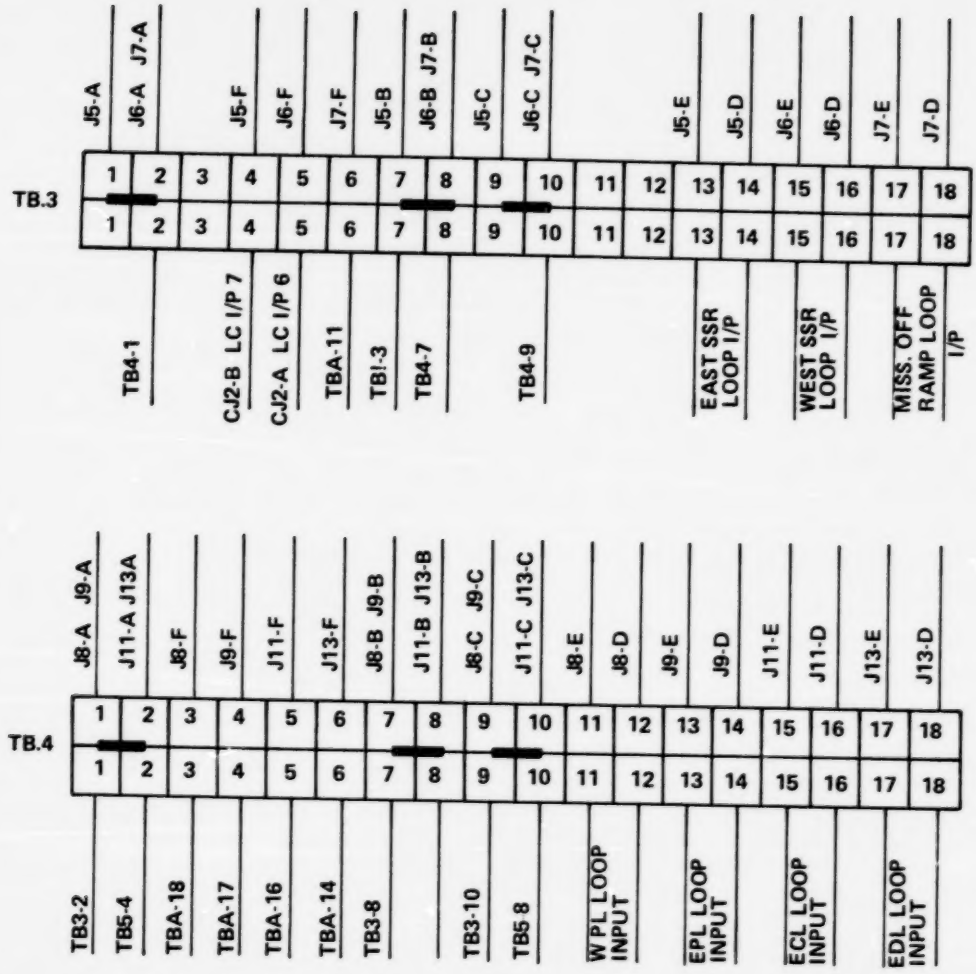


Figure 16a/ Terminal Blocks A and B



DET. AMP	PASS	DEM.	E.SSR	W.SSR	MISS OFF RAMP
	D31	D32	D34	D33	D35
CONNECTOR NO.	J3	J4	J5	J6	J7

DET. AMP	WPL	EPL	FWCL	ECL	WDL	EDL
	D42	D43	D40	D41	D38	D39
CONNECTOR NO.	J8	J9	J10	J11	J12	J13

Figure 16b/ Terminal Blocks 3 and 4

LC 1/P - 1 TO TB1-1
LC 1/P - 2 TO TB1-4
LC 1/P - 3 TO TB1-7
LC 1/P - 4 TO TB5-6
LC 1/P - 5 TO TB5-5
LC 1/P - 8 TO TB7-5
LC 1/P - 9 TO TB7-6

NOTE: MJ - Modem Connector.
CJ - Controller Connector

FIGURE 16c/ WIRING LIST FOR MISSISSAUGA ROAD SOUTHBOUND
(ADDITIONAL CABINET WIRING)

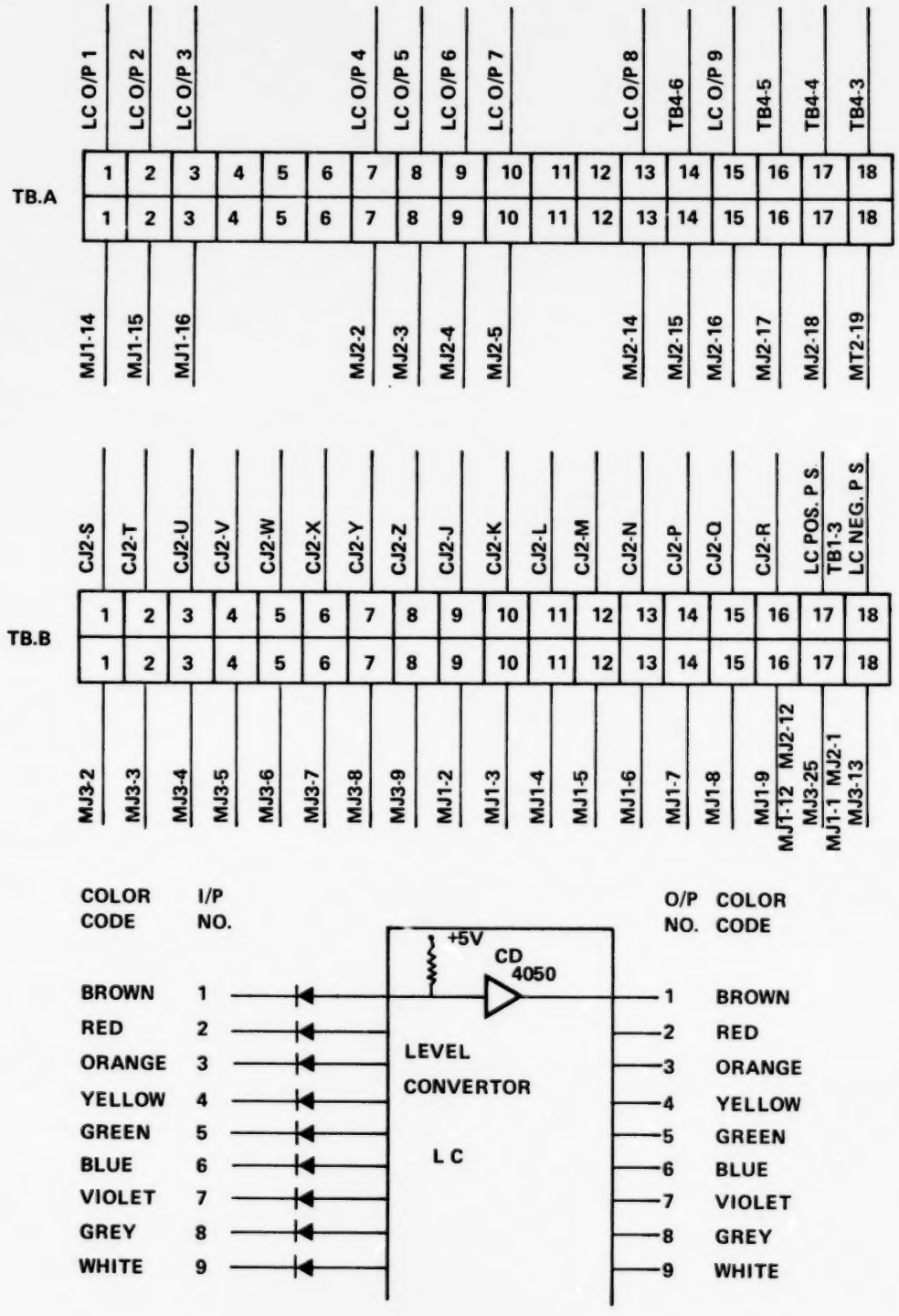
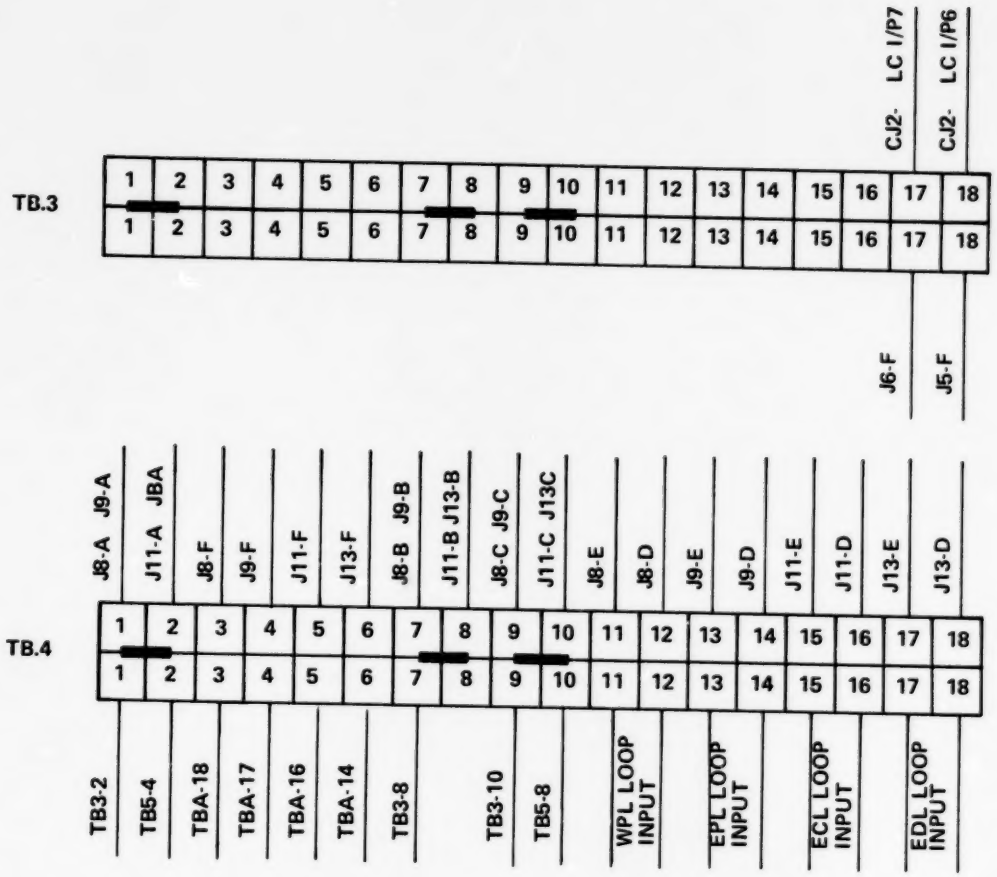


Figure 17a/ Terminal Blocks A and B



DET. AMP.	PASS	DEM.	N.B.Q.	S.B.Q.
	D68	D69	D70	D77
CONNECTOR NO.	J3	J4	J5	J6

DET. AMP.	WPL	EPL	WCL	ECL	WDL	EDL
	D75	D76	D73	D74	D71	D72
CONNECTOR NO.	J8	J9	J10	J11	J12	J13

Figure 17b/ Terminal Blocks 3 and 4

LC 1/P - 1 TO TB1-1
LC 1/P - 2 TO TB1-4
LC 1/P - 3 TO TB1-7
LC 1/P - 4 TO TB5-6
LC 1/P - 5 TO TB5-5
LC 1/P - 8 TO TB7-5
LC 1/P - 9 TO TB7-6

NOTE: 1) MJ - Modem Connector.
CJ - Controller Connector.

2) Northbound Queue (NBQ) and Southbound Queue (SBQ) detector amplifiers are located at the junction of southbound, Southdown Road and QEW eastbound off-ramp to Southdown Road.

FIGURE 17c/ WIRING LIST FOR SOUTHDOWN ROAD
(ADDITIONAL CABINET WIRING)

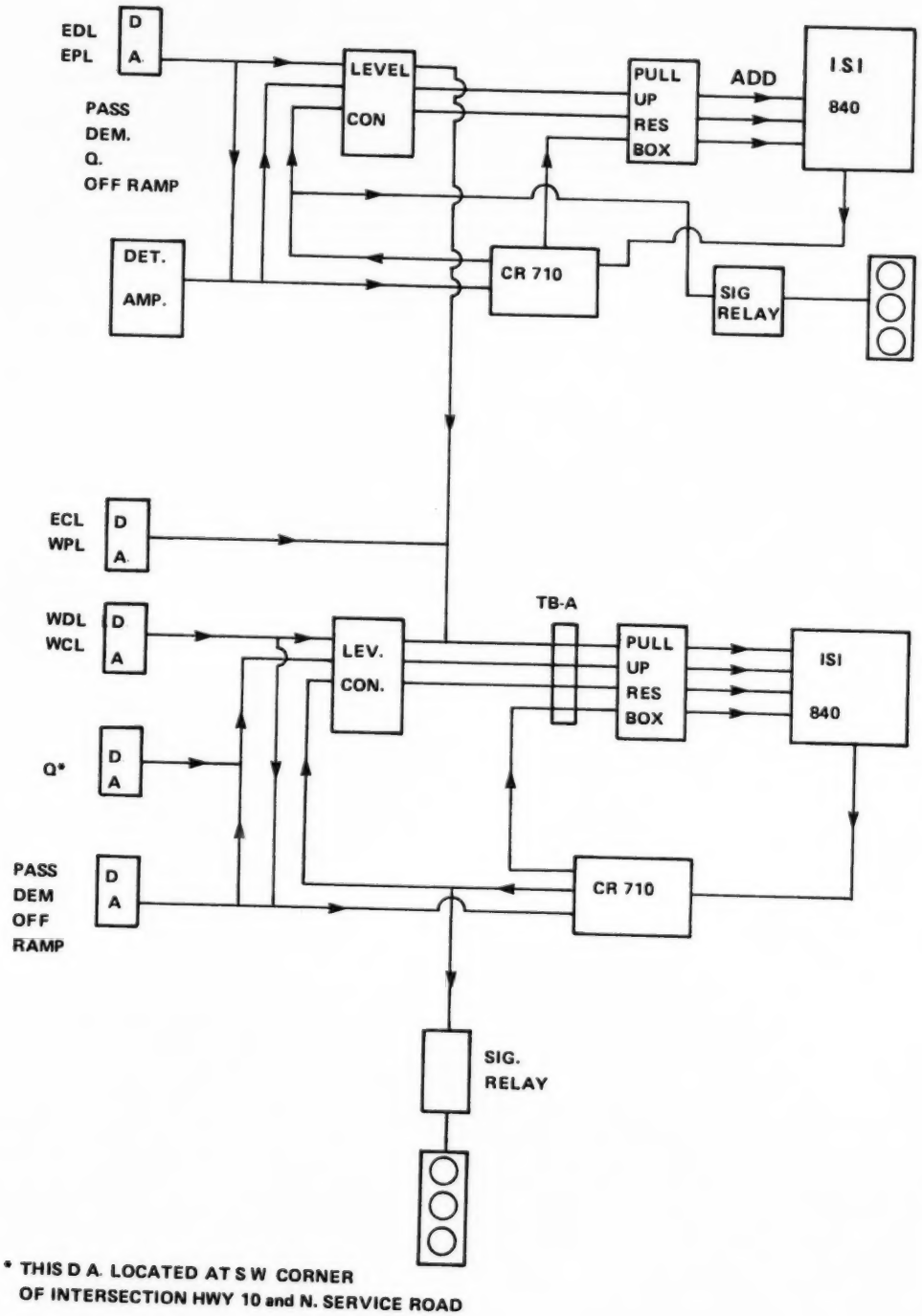


Figure 18/ Wiring Block Diagram for Highway 10 – North and Southbound

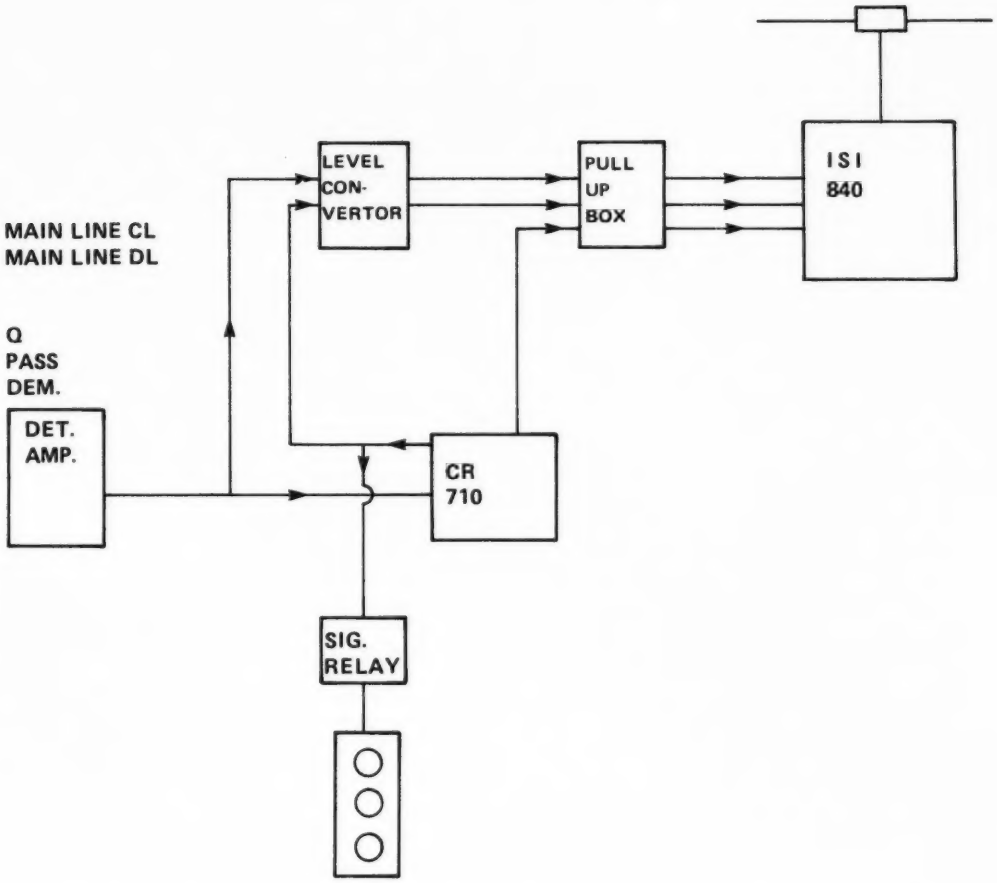


Figure 19/ Mississauga Road Northbound

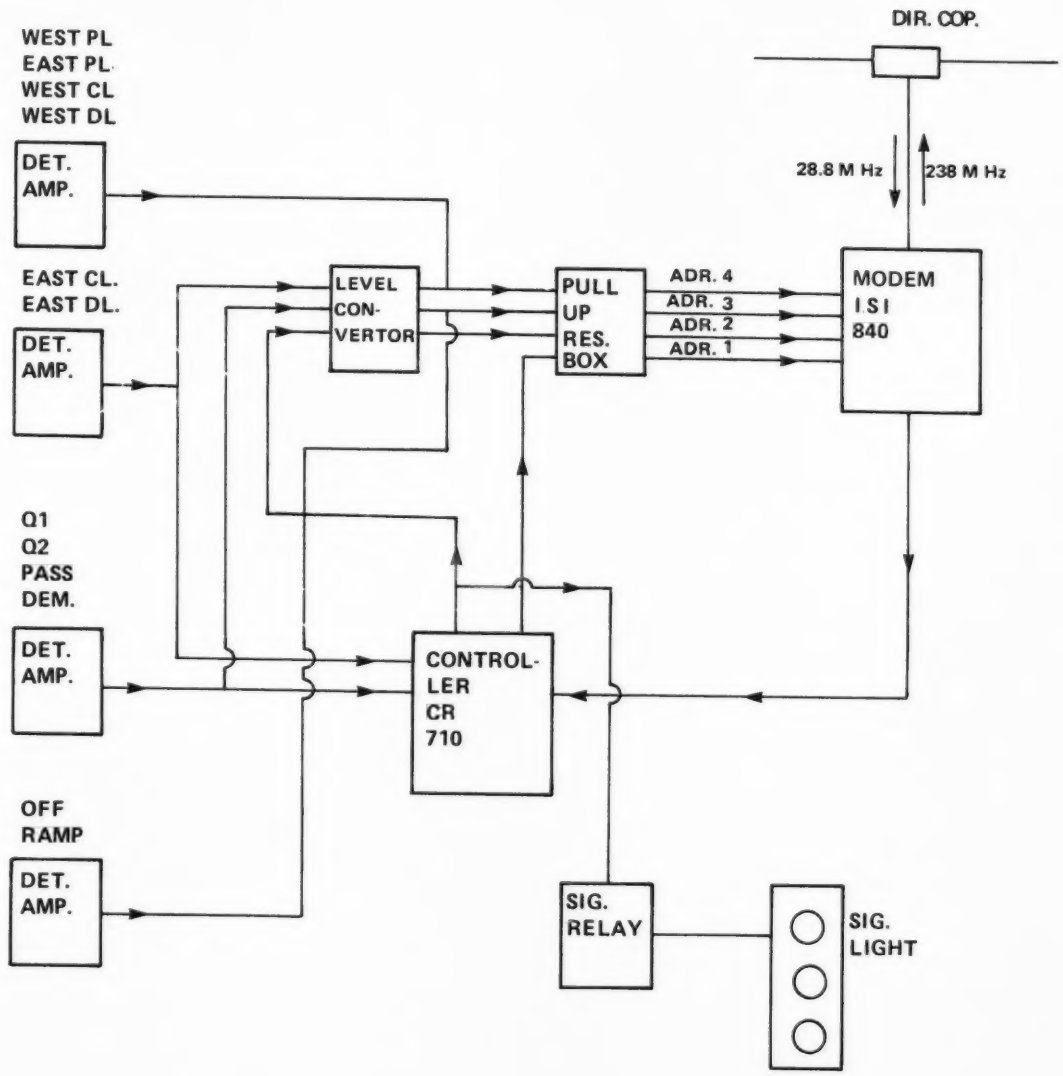


Figure 20/ Mississauga Southbound Wiring Block Diagram

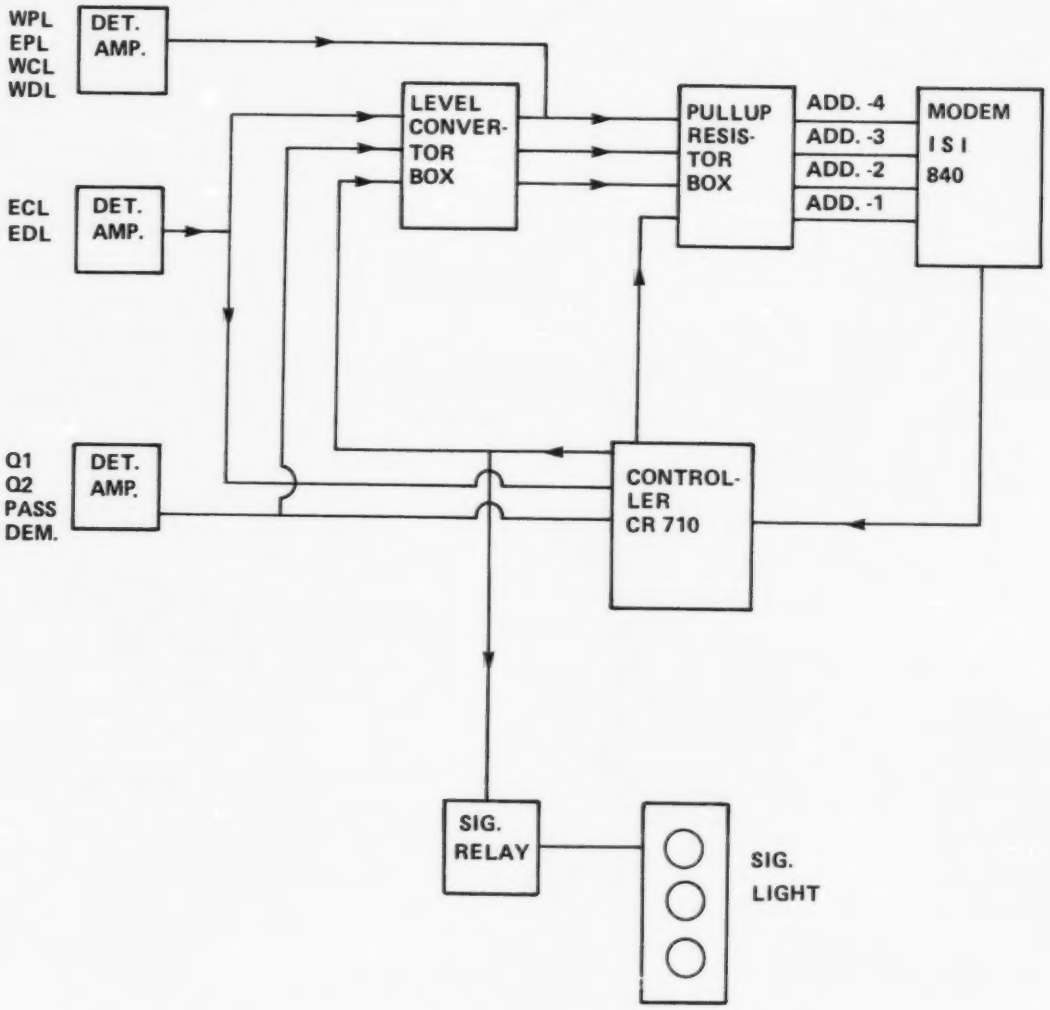
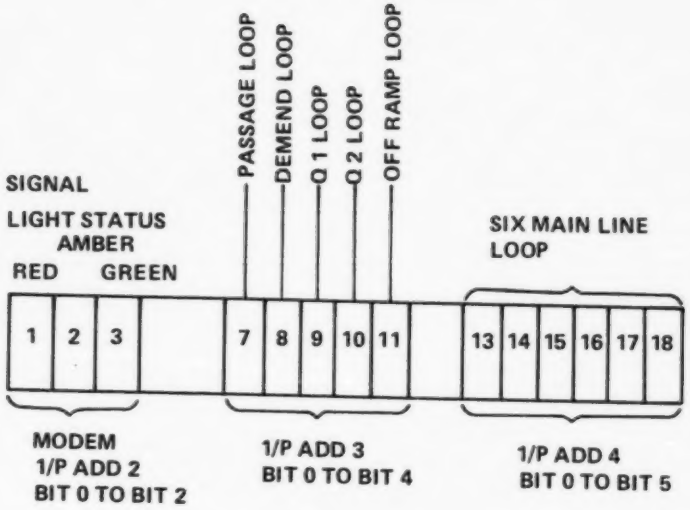


Figure 21/ Southdown Road Wiring Block Diagram


SIGNAL
LIGHT STATUS
AMBER
RED
GREEN
PASSAGE LOOP
DEMEND LOOP
Q 1 LOOP
Q 2 LOOP
OFF RAMP LOOP
SIX MAIN LINE LOOP
1 2 3 7 8 9 10 11 13 14 15 16 17 18
MODEM 1/P ADD 2 BIT 0 TO BIT 2
1/P ADD 3 BIT 0 TO BIT 4
1/P ADD 4 BIT 0 TO BIT 5

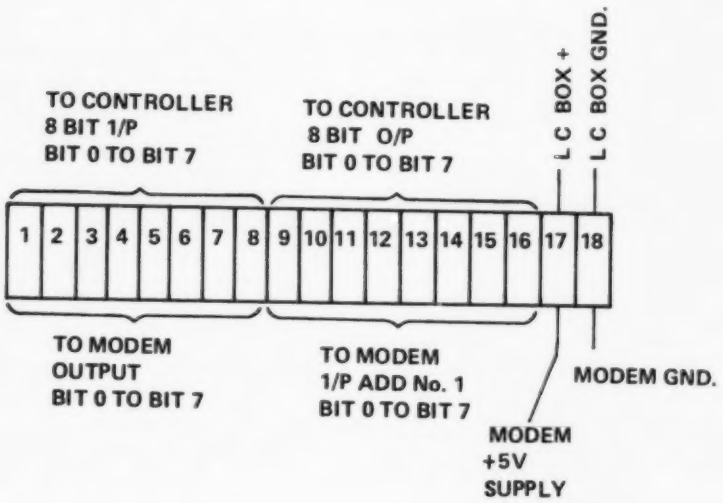

TO CONTROLLER 8 BIT 1/P BIT 0 TO BIT 7
TO CONTROLLER 8 BIT O/P BIT 0 TO BIT 7
L C BOX +
L C BOX GND.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
TO MODEM OUTPUT BIT 0 TO BIT 7
TO MODEM 1/P ADD No. 1 BIT 0 TO BIT 7
MODEM GND.
MODEM +5V SUPPLY

Figure 22/ Terminal Block A & B Functional Layout

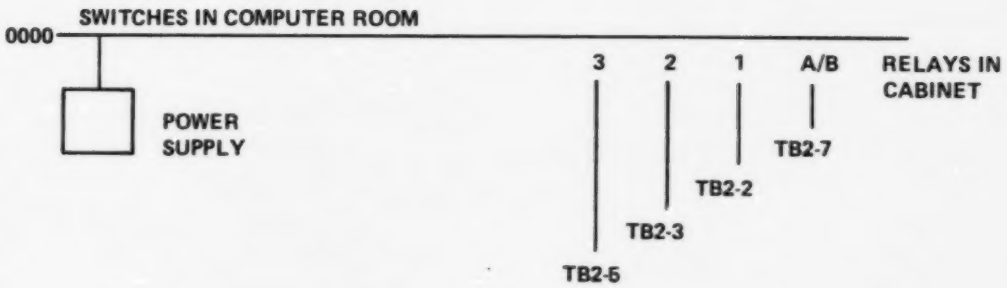


Figure 23/ Wiring Between the Manual Control Switches

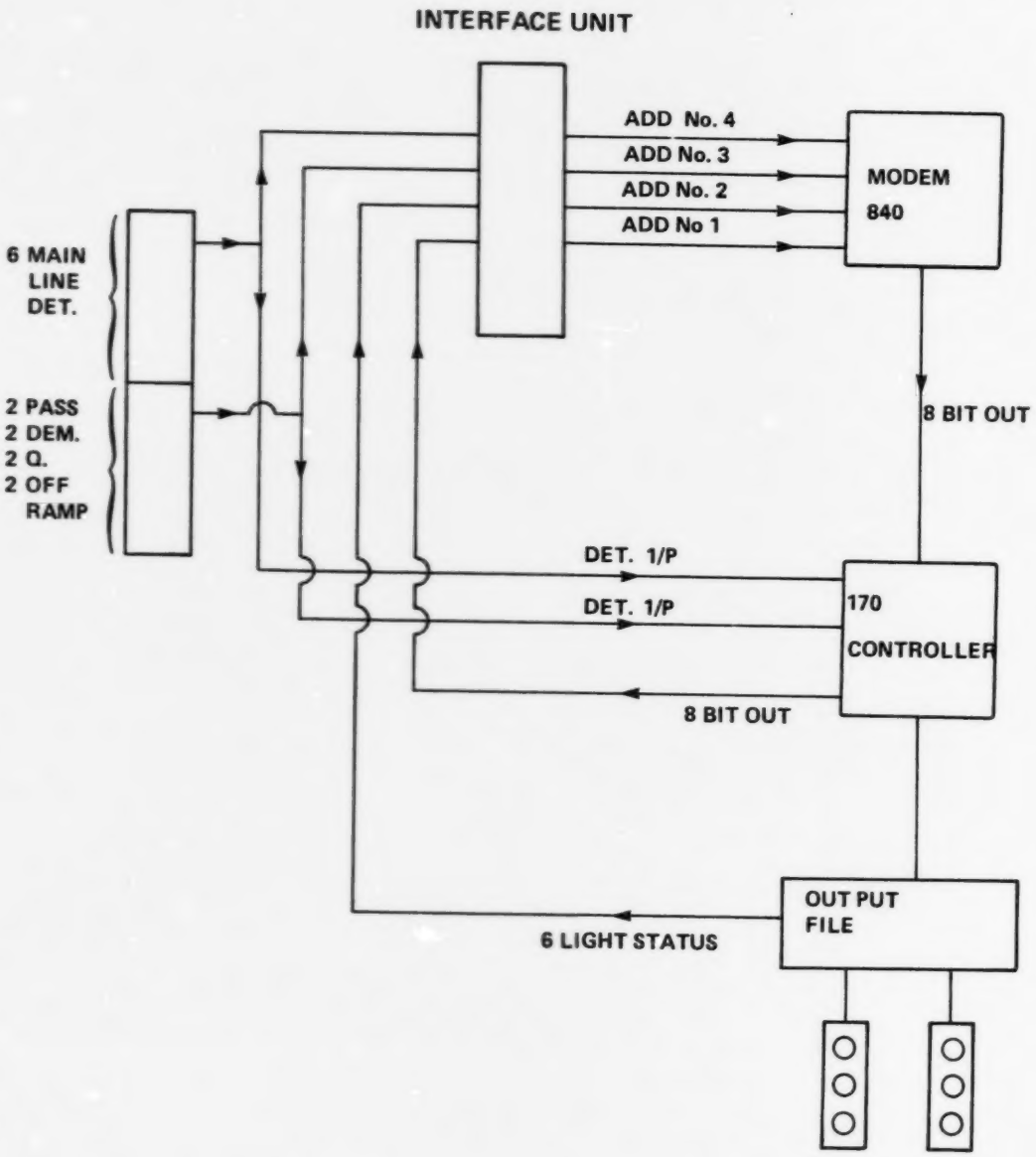


Figure 24/ New Ramp Controller Station Wiring Block Diagram

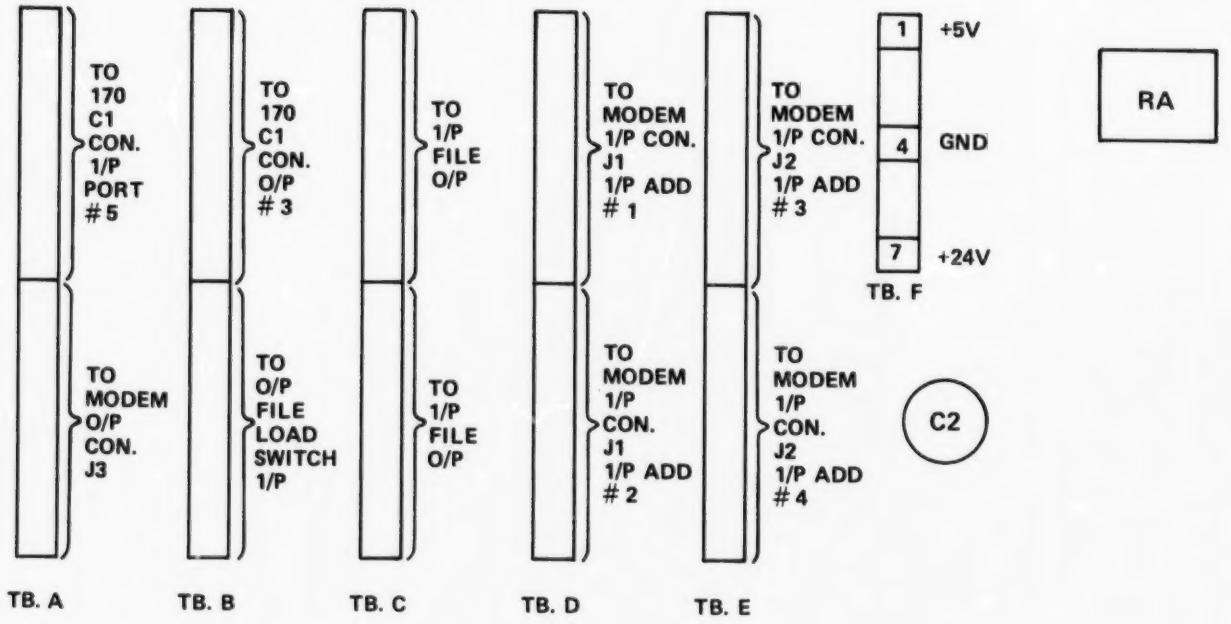


Figure 25/ Interface Unit Layout

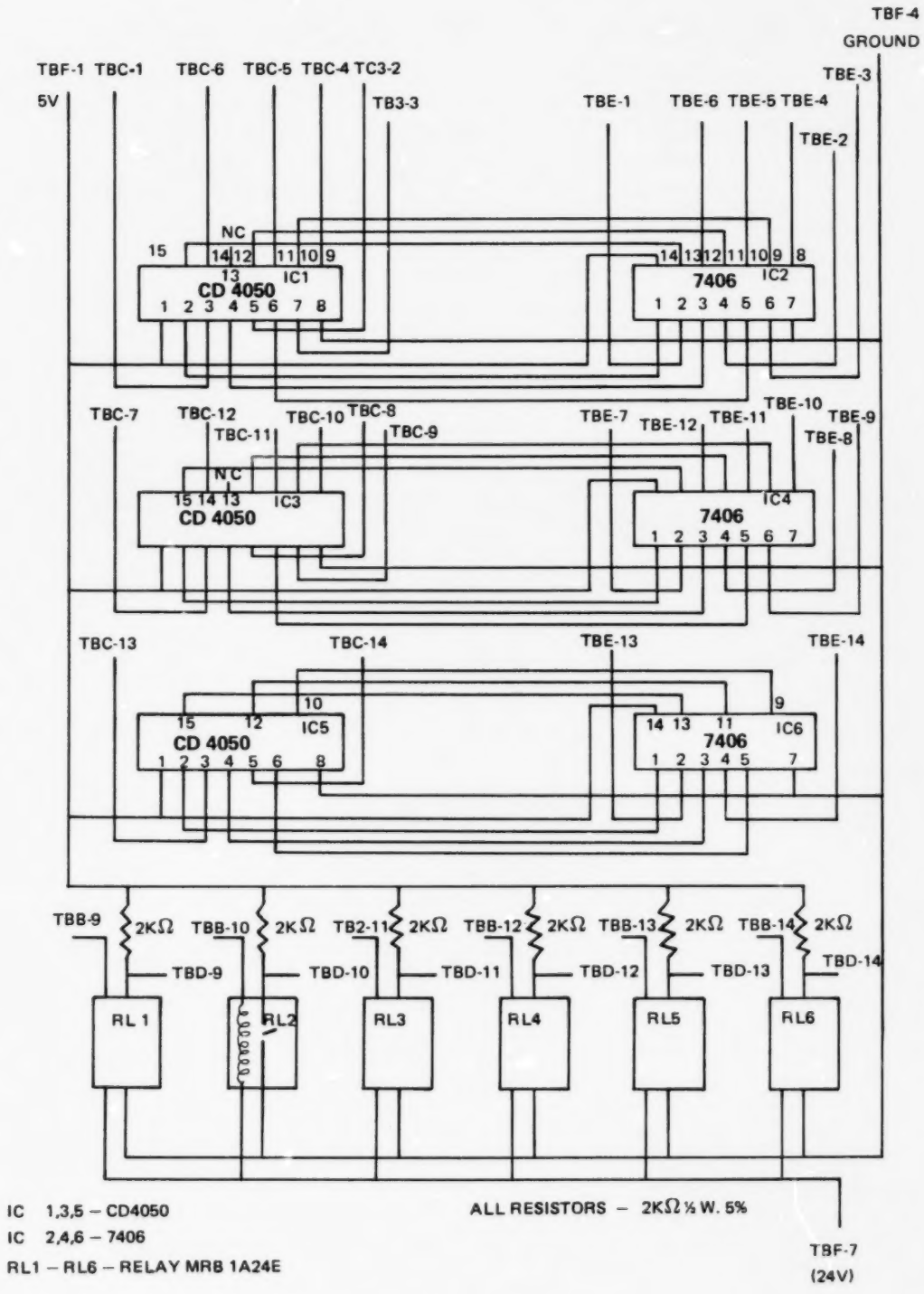


Figure 26/ Interface Unit Circuit Diagram

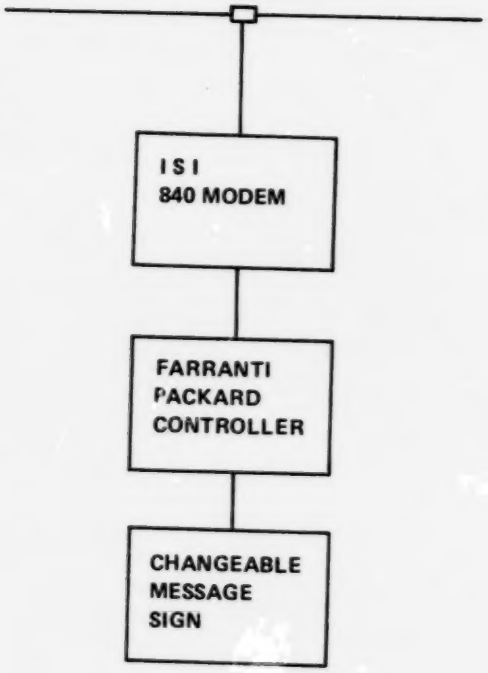


Figure 27/ The Changeable Message Sign Station

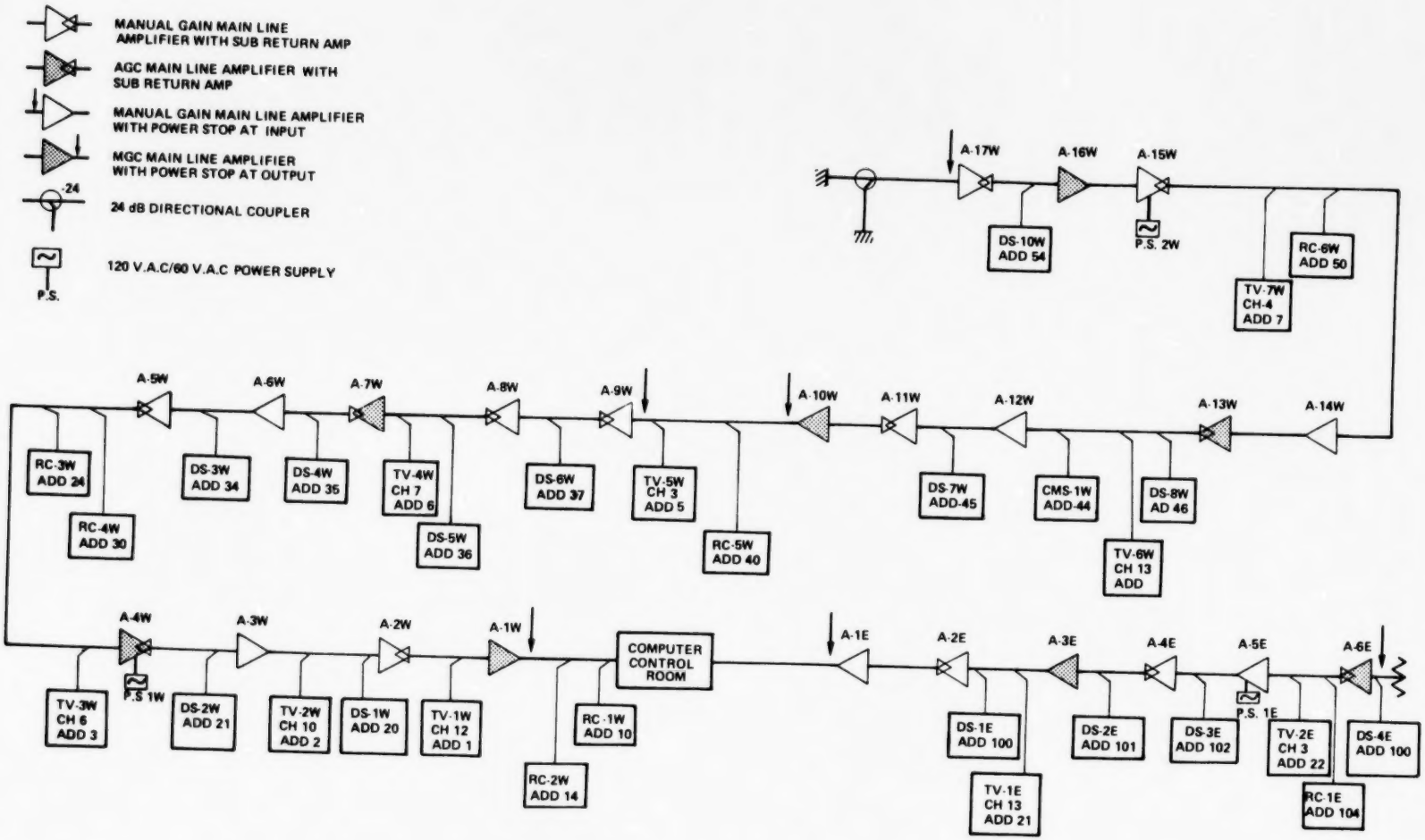


Figure 28/ QEW – Freeway Surveillance and Central System (FSCS)

Broadband Coaxial Trunk and Equipment Station Layout Diagram